ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 22. No. 4. WEEKLY. | NEW YORK, SATURDAY, MARCH 18, 1893. | $3 per Annum. Single Copies, 10 Cents.

Copyright, 1893, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

A new dynamo brush recently introduced in France is said to be a great improvement on those usually used there. It consists simply of a pile of exceedingly thin sheets of a copper alloy possessing antifriction properties. The sheets are about one-thousandth of an inch thick. They are said to last longer than those made of copper netting so often used abroad, and probably wear the commutator less.

A novel effect is introduced into the pantomime "Dick Whittington," at the New Olympic Theatre, London. When the hero goes to sleep to dream of success, the scene darkens, and a cloud-like screen in the background is seen to be lighted up by a multitude of tiny incandescent lamps. They twinkle and sparkle like veritable stars in firmament. One of the most beautiful star clusters, the constellation of Hercules, is faithfully represented. To produce the effect 400 lamps, run on 20 different circuits, are employed. For the desired variation in the brilliancy of these artificial stars, lamps of different voltages are used.

A clever contrivance has been invented for the detection of small pieces of magnetizable metal, such as needles, tacks, steel and iron chips, etc., that may have entered the human body unawares and hidden themselves in the skin or deeper tissues. The instrument was devised by Dr. J. B. Williams, and consists essentially of a partially astatic combination of small magnetic needles suspended within a glass tube, the tube being covered with tinfoil to minimize electric action, except for a small space through which the needle can be observed. It is claimed that the instrument is sufficiently delicate to detect the presence of one-eighth of an inch of steel or iron wire at a distance of six inches from itself. Such an instrument will be of the greatest service in many cases where the ordinary methods of detecting the presence of foreign metallic substances are ineffective and unreliable.

An electric railway extends across the old battle field of Gettysburg. It will not be long, however, before the people of the United States will be able to forget that there ever had been a quarrel called the civil war. As soon as the pensioners are gone then we can start in and forget.

The following is a paragraph taken from a modest little country newspaper, the writer of which has evidently shown great research and a considerate regard for the welfare and interest of the many "misguided electricians": "It seems strange that the electricians of this country have been misguided, and have blindly followed in the expensive footsteps of their predecessors. Up to the present day electricians have continued to use wires whose cross-section is a circle. Now anybody who has ever studied anything about electricity knows that the resistance of a wire decreases as the cross-section increases in square inches. Doesn't it seem foolish that they continue using round wire when you know what they can save by using square wire. Little squares will fit evenly in a large square, while there will be lots of space left over if you try to fit them into a circle."

Probably this individual regards the whole thing as a Chinese puzzle, and he thinks he has a solution. However, we may learn even from the mouths of babes and sucklings.

Messrs. Crompton, of Brighton, Eng., electrical engineers, have a clever little fox-terrier named "Strip," and she is under the special protection of one of their employés. The special feature of this little terrier is her manner of working with the men. The workmen lay down, in the desired position, a short length of the stout iron pipe which is to shelter a corresponding length of copper wire. The iron pipe having been fixed, Strip is called, has a wire fastened to her collar and goes in at one end of the pipe. The other end of the iron pipe has a bar across it, over which the copper wire must be strained to keep it taut. Strip having entered the pipe with the wire, presents herself at the other end to the workman awaiting her there, who thrusts his hand under the bar, unfastens Strip's collar and draws it and the wire out. Strip, when she feels her collar gone, turns round, retraces her steps, comes out again at the same end she went in at, and lies down to wait for her next call.

The Sawyer-Man Illuminating Company, of New York, in which Thomas C. Platt once invested $1,500, has filed a petition in the Supreme Court for voluntary dissolution. Assets, $4.60; liabilities, nothing.

GEN. T. T. ECKERT,

PRESIDENT WESTERN UNION TELEGRAPH COMPANY.

GENERAL T. T. ECKERT.

THE NEW PRESIDENT OF THE WESTERN UNION TELEGRAPH COMPANY.

Gen. T. T. Eckert, who was elected president of the Western Union Telegraph Company on March 8, to succeed Dr. Norvin Green, deceased, is a genial, self-reliant, approachable disciplinarian of magnificent physique and splendid executive ability. General Eckert has been the general manager of the company, and will continue to act as such until the next meeting of the board of directors.

Thomas Thompson Eckert was born at St. Clairsville, Belmont County, Ohio, on April 23, 1825. He learned telegraphy in 1849, and in that year held the positions of postmaster and telegraph operator at Wooster, Ohio. In 1852, after having superintended the construction of the lines over the Pittsburgh, Fort Wayne and Chicago roads, he was made superintendent of the Union telegraph lines. In 1859 he resigned to become superintendent of the gold mines in Montgomery County, North Carolina, but returned to Cincinnati in 1861. In 1862 General McClellan made him superintendent of Military Telegraphs for the Department of the Potomac, with the rank of captain and assistant quarter-master. In September, 1862, he was called to Washington, promoted to the rank of major, and put in charge of the Military Telegraph Headquarters in the War Department Building. He was thrown into confidential relations with President Lincoln and other prominent men of the time, and in 1864 was brevetted Lieutenant-Colonel, and made Assistant Secretary of War under Stanton. In 1865 he was brevetted Brigadier-General for distinguished service, and in 1866 he resigned his position of Assistant Secretary of War to become the general superintendent of the eastern division of the Western Union Telegraph Company's lines. He held that place until he become president of the Atlantic and Pacific, in 1875. When the present Western Union consolidation was effected, General Eckert was made vice-president, and has since been practically manager of the whole great system.

We present on this page an excellent likeness of General Eckert, made from a photograph taken within the past year.

Douglass & Connard, machinists, have in their possession a belt of huge proportions intended to be used upon the great Hamilton-Corliss engine of the Reading Electric Light Company. It is 130 feet in length and 58 inches in width, consisting of three thicknesses of leather. There was consumed in its manufacture the entire choice portions of hides from 300 steers. It is capable of transmitting 1,000 horse-power, and when in position will travel at the rate of one mile a minute. The weight of the belt is 1,483 pounds. Six weeks' time was required to complete the belt, five men being constantly at work upon it.

Thermal Storage for Central Stations.

READ BEFORE THE NATIONAL ELECTRIC LIGHT ASSOCIATION AT ST. LOUIS, MO., BY PROF. GEO. FORBES.

When asked to give you a paper on some electric lighting subject, it seemed to me that I could not choose a better one than thermal storage for central stations, which has had so much attention directed to it lately in England. It has long been evident that storage of some kind might lead to great economy in central station work. The reason of this is that the demand for light has, in most cities, a maximum for only two or three hours of the day. Not only do we require to have the plant lying idle all the rest of the day, but the expense of working for those few hours is increased by its temporary character. This loss of economy has occurred both in engines and boilers. Underloaded engines are very inefficient and use up a lot of coal. This defect is, however, got over in all important central stations by having at least a few engines of small power to carry the day load. We are thus able to have engines in use, always working at their most economical load, that is, near full load. The other loss in economy comes from the boilers which have to be fired up and heated only for a few hours' work and then banked or else allowed to cool down. This loss cannot be overcome by working the ordinary plant in any special manner. At the Kensington station in London, where the engines are always working at an economical load, five pounds of coal are used per electrical horse-power per hour, whereas in tests of 24 hours' duration, made on the same plant with all the boilers doing full work, only three and one-half pounds of coal were required for the same duty. If, then, we could have storage of any kind by which power is absorbed at times of light load and given off at times of heavy load, we should save one and one-half pounds of coal per horse-power per hour.

Many people have thought that storage batteries would overcome this trouble. It does so, but at an enormous capital expenditure in storage batteries, with a loss of 20 per cent. in the energy given to the batteries, and with a depreciation account which no one would put at a less figure than 12 per cent. per annum.

I have previously proposed that in a hilly country the boilers and engines should be working all the 24 hours, at the rate of the average demand, and that they should be used to pump water through a pipe to a high reservoir at least 500 feet above the pumping station. At the lower end of the pipe turbines are placed driving dynamos. During the daytime the reservoir is being filled and in the evening it is being emptied. This produces a saving in boilers and the substitution of cheap turbines and a small number of efficient pumping engines for a large number of less efficient engines to drive dynamos. It also reduces the coal consumption from five pounds to three pounds per horse-power per hour. In a paper read last year before the British Association for the Advancement of Science, I showed that this plan could easily be adopted at Edinburgh, in Scotland, the saving in capital and annual expenses being both very large.

But it is not every city that has these advantages, and I wish now to introduce to your notice the excellent scheme which has been invented by Mr. Druitt Halpin, of England.

He proposes to put up boilers only of the average capacity and to work them day and night, at times of light load the steam is carried through pipes into large iron reservoirs of cheap construction, and is used to heat up the water in these reservoirs to a high temperature and pressure. When the heavy demand comes on in the evening, steam is drawn from these reservoirs. The losses of heat from radiation from the reservoirs can be made very small, indeed, with proper lagging, in fact, quite imperceptible.

This is the general scheme of Mr. Halpin's plan. But it has two advantages which are not so apparent at first sight. One is the purity of water supplied to the boilers. Mr. Halpin's pumps feed water into the hot reservoirs when impurities are precipitated in a place where they can do no harm. The boilers, on the other hand, are free from this pure water in the reservoirs.

The other incidental advantage of the system is that priming in the boiler does not cause any inconvenience, as the steam is all supplied to the engines from the reservoirs. Now it has been found from the experience with the water tube boilers, which are so much used in this country, that only three pounds of coal per hour can be burned per square foot of heating surface, on account of excessive priming, instead of the six pounds per square foot which we can use with the Cornish or Lancashire boilers, and which might be used with water tube boilers if priming were no objection. Thus it appears that the adoption of Mr. Halpin's system not only reduces the number of boilers that we require, but also doubles the capacity of each boiler.

Mr. Halpin has worked out the relative cost of supplying machinery to the central stations of Berlin, (1) without any storage; (2) with storage batteries; and (3) with thermal storage. He first selected this station because the output at each hour of the day all through the year was published before any other central station had published similar data. In this system there are four central stations, giving off about 10,000 electrical horse-power.

The load, at different times of the day is such as to lead to the following data:

Maximum load	7,500 kilowatts.
Mean load	2,080 "
Excess of max. above mean,	3,080 "
Duration of ditto	7.5 hours.

Now, Mr. Halpin claims that he can replace 22 boilers for working in the ordinary way by five boilers and 92 of his storage cylinders, which are cheap to construct and have necessarily a small depreciation. His claims, which, I must admit, seem to be quite well founded, are that while laying out somewhat more capital on his plan, he gets a very large return from the extra capital spent. He sums up the cost of the thermal storage system as follows:

Five Babcock & Wilcox boilers, $27,050; boiler house, $9,500; chimney, $4,850; cylinder house, $33,300; 92 cylinders, $184,000. Total, $258,700, and he puts the cost under the existing system at $182,700.

Now, if we charge 10 per cent. to annual depreciation of boilers and only five per cent. on the iron cylinders, which really seems a very fair value, then the annual interest and depreciation comes out almost the same for both systems, thus:

Existing system—Five per cent. on $182,700 capital, $9,135; 10 per cent. on $117,850 boilers, $11,785; four per cent. on $64,850 building, $2,600. Total, $23,520.

Thermal storage—Five per cent. on $258,700 capital, $12,935; 10 per cent. on $27,050 boilers, $2,705; four per cent. on $47,050 buildings, $1,900; five per cent. on $18,400 cylinders, $9,200. Total, $26,740.

Annual charges against thermal storage, $3,220; but the annual saving in coal is, in this special case, 7,000 tons, besides the saving in ash removals and firing. Mr. Halpin thus obtains figures giving an annual saving of $36,530 to pay interest on extra capital of $75,000, with coal about $5 per ton.

Now, the only kind of storage against which Mr. Halpin has to compete, when high land is not available for utilizing water storage, is the storage battery; and from his figures, which seem fair to me, the extra capital required is $732,200 and the total annual extra cost is $110,570, which shows a great advantage in favor of thermal storage.

I consider that all these figures are very conservative, and that in these days when we are learning to realize the importance of cutting down working expenses in central stations, this system must necessarily occupy an important place. But it is of peculiar interest to me owing to its applicability to a kind of work to which I have devoted a large part of my time in the last seven or eight years. I refer to the burning of the house refuse and garbage in our cities. The furnaces in which this cremation is accomplished are generally called "Destructors." It has been one of the great objects before me of late years to have this title abolished, and to justify their being called "Utilizers." The improvements which we have introduced in the methods of burning refuse are so great that I can now undertake to produce the following results:

Taking the ordinary house refuse, consisting of ashes, coal, wood, paper, old boots, vegetables, bones and scraps, crockery, tin cans, iron pots, bottles, and adding thereto occasionally dead cats and dogs, infected mattresses and condemned meat, I can throw the whole of these, without sorting, upon the furnaces, and, without producing any offensive odors or dust, I can raise the temperature of the gases where they reach the boilers to over 2,000 degrees Fahrenheit. From my data as to the amount collected in different houses in England per head of the population I find that from the house refuse of any town I can supply enough steam to generate electric light at the rate of one 16 candle-power lamp per head of the population for two hours every night of the year. By doing this I am saving the municipality from $10,000 to $20,000 per annum per 100,000 inhabitants for the cost of removal of house refuse. I am preventing these objectionable materials from being dumped in the outskirts of the city, where building operations will soon commence, or in the neighboring harbors or lakes, either of which plans is a nuisance and unhealthy. The only resulting material is a clinker, which can be broken up, and which, when mixed with cement, makes admirable concrete or artificial stone for paving, while by itself it makes excellent foundations for roads.

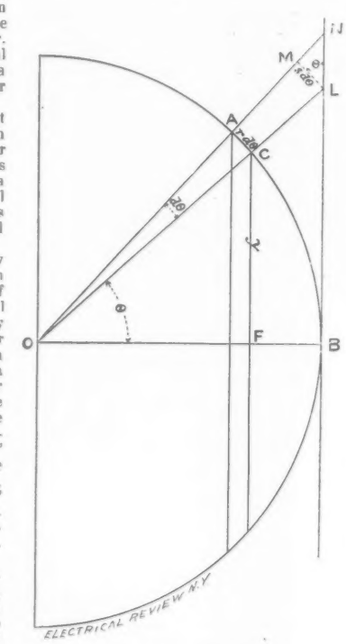
Now these enormous advantages, of the truth of which we have ample proof from a practice extending over nearly 20 years in England, can be worked at full economy only when the burning of refuse is quite continuous and uniform. To do this we must have storage of some kind. In hilly countries the plan I have advocated of water storage is far and away the most economical mode of working, and in this line alone, if in no other. I have always said, from the first moment I knew of Mr. Halpin's invention, that we have here the last item which was wanting in order to do away with the barbarous methods generally adopted for getting rid of house refuse, and at the same time utilizing that refuse in a manner that will confer material benefits on all the inhabitants of a great town, and pecuniary advantages on those who undertake the work.

LITERARY.

We have received "Transactions of the American Institute of Electrical Engineers" for December, 1892, and January and February, 1893.

Scribners' Magazine for March contains several remarkable articles in the line of "personal reminiscences and memoirs" which were announced to be one of the features of the year.

We have received a copy of the new (1893) edition of "*The Electrician* Electrical Trades' Directory and Hand-book," which has now reached its eleventh year of publication. The first number of the Directory and Handbook was issued in 1882, and consisted of about 100 pages; that for 1893 contains more than 1,000 closely printed pages. Each successive volume has clearly indicated the rapid growth of the electrical industries, until to-day the various applications of electricity find employment for hundreds of thousands throughout the world. The classified trades' section shows at a glance the large number of allied trades intimately associated with this growing industry; and the fact that a book of more than 1,000 large 8vo. pages can be filled annually with matter of the greatest interest to the trades served by the publication is convincing proof, if any were necessary, of the phenomenal advance the applications of electrical science have made in the past decade. The handbook section contains a mass of statistical information which is grouped together for ready reference, and which has proved of the greatest service to the electrical profession in past years. The new features added to the current issue will doubtless prove of equal value. Every effort has been made to bring the book up to date, and in the directorial section new names and addresses have been included up to the beginning of February, 1893.



ATTRACTION OF A HEMISPHERICAL SHELL.

Attraction of a Hemispherical Shell on a Unit Quantity of Matter at Its Center.

BY PROF. S. T. MORELAND.

In Daniell's "Text Book of Physics," edition 1884, page 168, we read:

"(7.) Between a hemispherical shell and a particle at its center, the attraction is $f = \kappa 2\pi\sigma$. * * * (8.) Between an indefinite plane and a body at a finite distance x from it, the attraction is the same as in case 7, and $f = \kappa 2\pi\sigma$."

On page 119 of Barker's "Physics," recently published, may be found substantially the same statements, the value for the indefinite plane being derived from the assumed value for the hemispherical shell, on the supposition, apparently, that they must be equal. Now, it is not true that they are equal; $\kappa\pi\sigma$ is the value for the hemispherical shell, while $\kappa 2\pi\sigma$ is correct for the indefinite plane. As the error has appeared in these two prominent books, it may be worth while to show that it is an error by giving the proof for the correct result.

Let the figure be a section of the shell and of a plane tangent to it. Also let

$O B = r$

$O L = s = \dfrac{r}{\cos\theta}$

$F C = y = r \sin\theta$

$B L = S \sin\theta = \dfrac{r \sin\theta}{\cos\theta}$

σ = mass of unit area, that is, the surface density.

Suppose, now, the figure to revolve about O B. The arc A C will generate a narrow zone of the hemisphere, and the line N L a narrow ring of the plane. We have:

Breadth of zone = A C = $r\,d\theta$

Circumference of zone = $2\pi y = 2\pi r \sin\theta$

Area of zone = A C $\times 2\pi y = r\,d\theta .\ 2\pi r \sin\theta$

Mass of zone = $\sigma .\ r\,d\theta .\ 2\pi r \sin\theta$

Attraction of zone on unit mass at

$$O = \frac{\kappa\sigma\, i\, d\theta\, 2\pi r \sin\theta}{r^2}$$

(where κ is a constant)

$$= \kappa 2\sigma r \sin\theta\, d\theta$$

This attraction makes an angle θ with O B, which is evidently the direction of the resultant attraction; we must, therefore, multiply by $\cos\theta$ to get the attraction of the zone in the direction O B.

Attraction of zone along O B = $\kappa 2\pi\sigma \sin\theta\, d\theta \cos\theta$; and

Attraction of hemispherical shell along

$$O B = \int_{\pi}^{0} \kappa 2\pi\sigma \sin\theta \cos\theta\, d\theta$$

$$= \kappa\pi\sigma$$

For the plane we have:

Breadth of ring = N L = $\dfrac{s\,d\theta}{\cos\theta} = \dfrac{r\,d\theta}{\cos^2\theta}$

Circumference of ring = $2\pi \times$ B L = $2\pi S \sin\theta = \dfrac{2\pi r \sin\theta}{\cos\theta}$

Mass of ring = $\dfrac{2\pi\sigma r \sin\theta .}{\cos\theta} \dfrac{r\,d\theta}{\cos^2\theta}$

$$= \frac{2\pi\sigma r^2 \sin\theta\, d\theta}{\cos^3\theta}$$

Attraction of ring = $\dfrac{\kappa 2\pi\sigma r^2 \sin\theta\, d\theta}{\cos^3\theta}$

$$= \frac{\kappa 2\pi\sigma r^2 \sin\theta\, d\theta}{\cos^3\theta} \frac{\cos^3\theta\, S^2}{r^2}$$

$$= \frac{\kappa 2\pi\sigma \sin\theta\, d\theta}{\cos\theta}$$

Attraction of ring along O B = $\kappa 2\pi\sigma \sin\theta\, d\theta$

Resultant attraction of indefinite plane

$$= \int_{\pi}^{0} \kappa 2\pi\sigma \sin\theta\, d\theta = \kappa 2\pi\sigma,$$

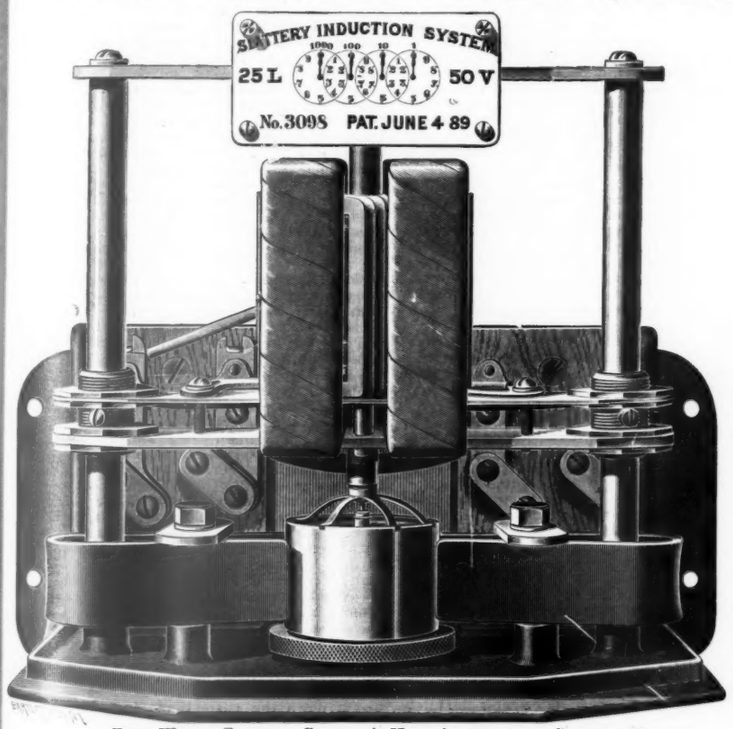
a well known result.

It will be readily found that the arc A C attracts a particle at O exactly the same as the line N L does, and it is this fact that seems to have led to the conclusion that the attraction of the zone is equal to the attraction of the ring. The above work shows, however, that the attraction of the zone is $\kappa 2\pi\sigma \sin\theta\, d\theta$, while that of the ring is $\dfrac{\kappa 2\pi\sigma \sin\theta\, d\theta}{\cos\theta}$.

These results apply, of course, to electricity, if we take σ to mean the quantity of electricity an unit area.

An Accurate Meter for Alternating Currents.

A well-made and accurate recording alternating current meter, manufactured by the Fort Wayne Electric Company, is shown in the accompanying illustration. The special feature of this device is the possibility of recording accurately with a small load. The two coils are arranged angularly and carry, respectively, the primary and secondary alternating currents. They surround a rotating cylindrical copper armature with two or more iron rings, and as a result of the lag of phase a rotary motion is produced. For meter work retarding vanes have been used, and thus proportionately reduce the speed for convenience in registering, but in this meter the retardation is effected by means of a copper cylinder, shown below the armature, on the same shaft with it, and within the field of permanent magnets. The readings are direct and are either in lamp hours or ampere hours. For transportation, the meter is provided with a locking device to raise the shaft from its jeweled bearings, and to hold it rigidly when the meter is not in use. The binding posts are marked "house" and "transformer," to avoid any possible accidents arising from wrong connections.



FORT WAYNE ELECTRIC COMPANY'S NEW ALTERNATING CURRENT METER.

ELECTRIC RAILWAY AND POWER NOTES.

The recent storms have done considerable damage to the trolley lines in the vicinity of Fall River, Mass.

The Northwest General Electric Company has declared a two per cent. quarterly preferred stock dividend, and made the same payable March 7.

The Traction Company, of Philadelphia, has decided to dispense with the cable and, if councils grant the necessary permits, the trolley will be substituted.

A bill has been passed in Albany authorizing the Schenectady Electric Railway Company to furnish light, heat and power for Schenectady and Rotterdam, N. Y.

The electric railway from Portland to Oregon City, Ore., has been formally opened. It is 14 miles in length, and the running time between the two cities is one hour.

The annual stockholders' meeting of the General Electric Company will be held in Schenectady, N. Y., Tuesday, April 11, at noon. Books close March 18 and re-open April 12.

Work has been commenced on a new enterprise in Augusta, Ga., which means much for the improvement of that place. The Murray Hill Company have started surveying on this route for their electric road six miles above the city.

The Detroit Citizens' Street Railway Company took charge of the Highland Park Railway last week, and is now running it on the same general plan as all the other suburban lines under its control. The fare will remain the same as before.

It is expected that the East Cleveland and Broadway Street Railway, of Cleveland, O., will announce a consolidation in a few days. All the preliminary arrangements have been completed and only the formalities remain to be concluded. The capital of the new company will be $8,000,000. In forming a pool the East Cleveland Company enters its property as worth $5,600,000 and the Broadway at $2,400,000.

W. A. Tucker, representing a syndicate of Boston capitalists, has asked permission from Montclair (N. J.) aldermen to run an electric road through the streets of Montclair from West Orange. The company, he said, has $5,000,000 of capital, and intended to spend $750,000 in equipping the road. It also proposes to build an electric light plant similar to those at Hoboken to supply the neighboring towns. It is proposed, Mr. Tucker said, to make it a home affair, a director to be chosen from each town through which a road passes. The Montclair aldermen decided to consider the proposition and to give an answer soon.

Street Railway Legislation in Pennsylvania.

BY HOMER SHOEMAKER, ATTORNEY, HARRISBURG, PA.

Several quite important bills affecting street railway interests in Pennsylvania are now pending in the legislature. The McCarrell bill, which has passed finally in the Senate and will likely pass in the House, provides that any street passenger railway company, incorporated under the laws of Pennsylvania, is authorized to sell or to lease, or to lease and to sell its property and franchises to any traction or motor power company incorporated under Pennsylvania laws. Any such company may contract with any such traction or motor power company or companies for the construction upon and along its line of railway of motors, cables, electric and other apparatus and appliances, and for securing the payment of the price thereof by bonds, by mortgage of its franchises and property and otherwise.

Contracts may also be entered into between any such companies for the operation of the lines of railway of such railway companies.

In the event of this bill becoming law, consolidations of street railway lines in Pennsylvania will be of little difficulty.

Suburban and country lines running along public highways will be much benefited if Senate bill No. 202 becomes a law. It provides that where any of the public highways within this commonwealth are so located as to become filled with snow, by reason of board or rail fences along their sides, it shall be lawful for the road supervisors of the township wherein the road is situated, with the consent of the board of auditors, to pay the owners of such fence for removing the same and erecting in its stead a fence of post and wire.

A bill is also pending giving street railways the right to haul light freight, provided that not more than one freight car is attached to one train.

The Telegraphic Tournament.

The managers of the telegraphic tournament, which is to be held at Hardman Hall, on March 25, for the benefit of the Telegraphers' Mutual Relief Fund, have received a pleasant bit of encouragement in the form of a telegram from San Francisco authorizing the offering of two prizes on behalf of Mr. John W. Mackay. These are to be gold medals, worth $150 and $100, for the two best typewriter receivers on messages only. Thomas A. Edison and others have also offered prizes.

The prizes offered by the management will cost about $1,750, and the competitions will include six classes—a ladies' class, a message class, fast sending for those who have never sent more than 230 words in five minutes in a tournament, for those who have not sent more than 235 words, for the Walter P. Phillips code, and the champion class.

A team of telegraphers is coming from San Francisco to enter the tournament, and entries have also been received from many other parts of the country.

The Storey Motor.

Mr. I. E. Storey, after several years of experiment, has invented an electric motor especially applicable to the driving of machine tools, and which is water, dust and fire proof. This motor is of a high mechanical quality and has a maximum electrical efficiency for its weight. It is claimed to be entirely free from magnetic leakage. It is a plain cylindrical machine having projections for the boxes and commutator.

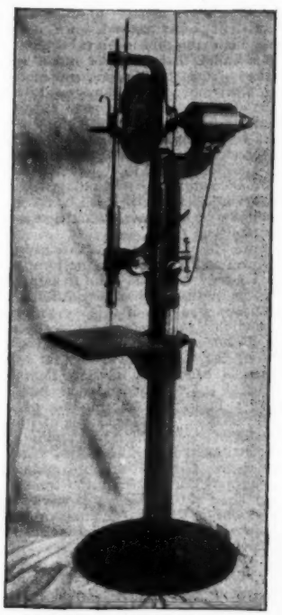


FIG. 2.—STOREY MOTOR COMBINED WITH TWELVE-INCH UPRIGHT DRILL.

One of the unique features of this machine is in the construction of the field magnets, as shown here, a four pole machine. While the center of this machine is of one polarity the ends are of opposite polarity, both ends being of the same polarity. Thus there are eight distinct magnetic circuits making the path of the magnetic circuit uncommonly short and of very low resistance, giving maximum efficiency for minimum quantity of wire.

The armature is of the drum type, toothed. The bearings are of peculiar construction, and so designed that the motor may be placed in any position as long as the center line of the shaft is horizontal. The machine is practically a solenoid, and will be known as the solenoid type.

The manufacturers of this motor, the Hornell Iron Works, Hornellsville, N. Y., are now in the market with motors adapted to grinding and buffing, the operating of drills and small tools, and transmission of small power. The Dahl Electric Company, 120 Liberty street, New York, are the agents for the manufacturers for the Eastern and Middle States.

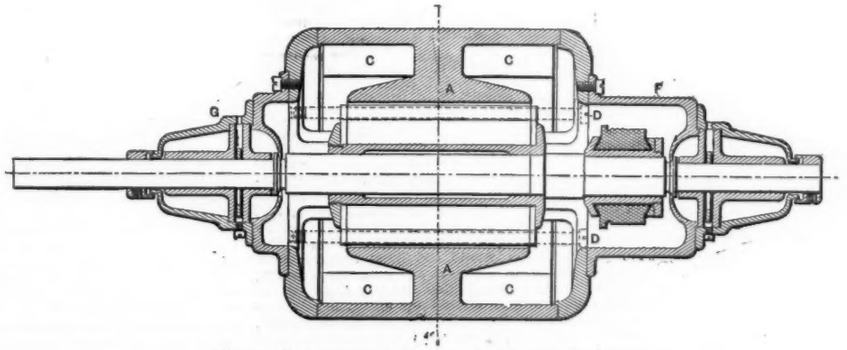


FIG. 1.—LONGITUDINAL SECTION OF STOREY MOTOR.

A fire in the cable tower of the Western Union Telegraph Company, at Communipaw, N. J., recently, caused considerable damage to the southern wires.

Power Transmission for Central Stations.

READ BEFORE THE NATIONAL ELECTRIC LIGHT ASSOCIATION, AT ST. LOUIS, MO., BY DR. LOUIS BELL.

This paper makes no pretense at being an exposition of the theory and practice of long distance transmission of power, nor in it shall I attempt to go into lengthy discussion as to the relative merits of various methods and divers apparatus, none of which has been in use long enough to permit a ripe judgment of its relative qualities. I shall confine myself to discussing the question of power transmission as it appeals to the man who runs a central station, bearing in mind that, however much may be learned from theoretical considerations, theory often needs to be chastened by facts.

If the problem arises of transmitting electrical energy from a distant point for use in light or power distribution, we must ask ourselves, before answering the all-important question of "Will it pay?" first, what are the conditions surrounding the transmission as such, and second, what are the conditions of the distribution that is to be accomplished?

If we simply desire to take a given unit of power and transfer it in the form of electrical energy from one point to another, the facts in the case are widely different from what they would be if it is necessary either to subdivide that power unit at the receiving station or to scatter it along the entire path of the transmission. So far as distribution is concerned, we may then divide electrical power transmission into three classes: First, the transmission of single units; second, the transmission of power to a center of supply, from which point it is to be distributed in various ways; third, supplying the power for lights and motors throughout the length of the transmission line. Each of these classes of work imposes conditions on the possible methods of transmission, and requires special consideration. In new plants, hampered in no wise by existing stations, any one of these three cases may exist, perhaps the last two more frequently than the first. Where a single motor is to be employed, the problem is exceedingly straightforward. Where a new center of distribution is to be organized, some complications are encountered, but not serious ones. Where power is to be scattered along the line, however, conditions arise which are not altogether easy of fulfillment and require a good deal of special care and skillful engineering.

A single power unit may be delivered over ordinary working distances by apparatus of various kinds with almost equal facility. Where a center of distribution is to be supplied, we are often limited in a new plant to such apparatus as will cheaply and effectively enable us to distribute both light and power, but the secondary part of the problem, that is, the distribution, may be accomplished by following well-known lines of work. Where scattered motors are to be served, we are still further limited on account of the inordinate variations of voltage that may occur.

To the working central station man, occupied with the details of a growing business, power transmission from a distant water fall possesses a direct pecuniary interest, and he is most generally concerned in the practicability of either displacing his engine and swiftly diminishing coal pile by electric motors to drive his station or transmitting energy from the same distant point to help out his present plant and enable it to be enlarged. Under these conditions, the question of method becomes largely one of dollars and cents. Some times a considerable saving may be effected by using part of the apparatus already on hand, for example, moving his arc machines and alternating lighting machines to the water power, if it is not too far away, and transmitting power only for his power circuits or direct current lighting circuits. In a general investigation of the methods which may be employed, the case stands somewhat as follows, so far as the central station man is concerned:

First, if the distance over which he is to transmit power is moderate, he may use the ordinary direct current generator and motor, displace his engine with the motor and go ahead. But unfortunately, direct current machines of any considerable capacity are practically limited in voltage by the existence of the commutator, an article on which central station men in general waste no love. Dynamos and motors of large size cannot, individually, in the present state of the art, be satisfactorily built for more than about 1,200 volts. Machines for greater voltage have very generally broken down in the experimental stage. For very small power units, arc machines might be employed, but for the purpose of the central station man, it is better to move his arc machines directly to the distant point. For voltages much in excess of that mentioned, we are then driven to the use of either direct current machines in series or alternating machines.

Where generators and motors are to be used as a single unit, direct current machines in series may be and are employed quite successfully, but as the voltage desirable on the line rises, the system contains a greater number of units and becomes more complicated and difficult to apply to central station practice. For instance, it is highly desirable for the successful operation of motors in series that they should be, practically, coupled to the same shaft, and should run under similar and uniform conditions, so while there are cases in which the method of coupling in series may be both convenient and cheap, it is, in my opinion, better general practice to employ alternating currents, after passing the ordinary limitations of direct currents.

Here we encounter a complicated state of affairs, for the central station man who attempts to investigate the subject is immediately surrounded by a cloud of mental dust through which he sees dimly the outlines of plain alternators, biphase, triphase and multiphase generators and motors, condensers, Geissler tubes, six foot fuses, electrified wall paper and the other properties of a well equipped, modern high voltage electrician. The substance of the matter, however, is something as follows:

We want to use power transmission by alternating currents for two good and separate reasons; first, because we get rid of the commutator, and can, therefore, use as high voltages as we can safely insulate in the machine; second, because by the use of transformers we can obtain for the transmission line itself any voltage which we can insulate, and thereby enormously decrease the cost of the copper which must be stowed away as permanent investment in our line.

Multiphase currents, and by this I mean currents having more than one phase, are subject to the same general laws as any other alternating currents. Their most valuable peculiarity lies in the fact that for alternating currents of more than one phase excellent motors can be built which will run at a steady speed, start under heavy load, and in general possess very much the same qualities as a well organized shunt motor of the ordinary kind. Incidentally, certain of the multiphase systems, more especially the threephase, enjoy the advantage of effecting something of a saving in copper, under favorable circumstances up to 25 per cent. from what would be required by a plain alternating current of the same nominal voltage. This saving is merely from the fact that in the threepnase line the currents do not have their highest value at the same time, so that at any particular instant two of the wires may serve as a sort of multiple return for the third. This advantage would be immediately thrown away if for the three currents of different phase three separate pairs of wire were employed, as it is thrown away where for two currents of different phase two independent circuits are used.

The fundamental difference between single and multiphase systems then, is mainly the adaptability of the latter for driving motors, and multiphase are better than single-phase motors principally in their ability to start under load, and somewhat larger output for the same weight.

Wherever, then, single motors are to be driven for operating, we will say, an electric light station, it is largely a matter of convenience whether we employ single or multiphase motors. If the former can be conveniently started, they are fully competent to take care of the work, except in one special case, which I will mention presently. The multiphase motors, whether synchronous or otherwise, start very freely, and may or may not be economical in cost of copper, according to the arrangements of the circuits, as I have before mentioned.

A single case in which multiphase transmission becomes of great importance when the object is to work an existing central station, is in that case where railway circuits are to be supplied. A railway machine is subject to so great and violent variations of load that if it were driven by an ordinary synchronous alternating motor, the latter would run great risk of being pulled out of phase by a sudden short circuit, when it would stop and stay stopped until deliberately started up again. The multiphase motor can also be pulled out of phase, but not quite so easily, and it can be more readily started. We can, however, where railway currents are necessary, do much better than to drive the dynamos directly by motors of any kind. We can for this use start with the multiphase current, and through the medium of a single machine, scarcely more complicated than an ordinary railway dynamo, transmute this multiphase current into a direct 500 volt current of the ordinary sort. This very valuable result has been brought about through the ingenuity of my friend, Mr. C. S. Bradley, who invented the device a half dozen years ago. It has lain dormant, principally because there has been no special call for power transmission of any kind until recently; but to its thorough practicability, I can personally testify, as a 100 kilowatt triphase direct current transformer which I recently tested, operated in the manner described, showed an efficiency of over 95 per cent. at full load, stood sudden variations from no output up to 100 kilowatts and back again without even a wink at the brushes, and bore up under heavy overload without difficulty. Whenever it is desirable to operate railway circuits by power derived from a distant source, these machines fulfill all practical requirements, and, I believe, are destined to come into very extensive use, and play an important part in the development of very long electric railroads.

To sum up this point, where single motors are to be employed for driving other electrical machinery, either synchronous, alternating or multiphase motors of various sorts can be successfully employed; where railway dynamos form a part of the load, a particularly good result can be obtained by using for this particular portion of the work, the multiphase direct current transformers. So much for the operation of existing plants by electrical transmission of power, where it is merely intended to substitute a motor or motors for an engine.

Now, take up the case where a center of distribution is to be fed, consisting, it may be, in part of an existing station and in part either of extensions and new circuits from this plant, or subsidiary centers of distribution having other districts of the same town. Here the problem becomes more complicated and it is almost impossible to lay down any general procedure. Each case is best handled by itself. We can, however, enunciate certain principles which will aid in the discussion of any definite case.

First, we can feed all existing railway circuits and extensions thereof very effectively and economically by use of the triphase direct current transformer just described.

Second, we can handle all direct current incandescent systems, whether two or three wire, by means of the same type of apparatus, the tri-phase direct current transformer.

Third, we can successfully operate any existing alternating incandescent circuits or any extensions thereof by feeding alternating current from the distant point directly into them through banks of transformers.

Fourth, if any new centers of distribution are to be made with circuits independent of those already in existence, we can operate these circuits very effectively for both lighting and motor service, if both be necessary, by employing multiphase apparatus, and right here let me say that there is one widely-spread error which I desire most emphatically to contradict.

It has been asserted that incandescent lighting cannot be successfully done on multiphase systems, especially triphase, since this system happens to have been most talked about. This statement is absolutely false to my own personal experimental knowledge. Lamps can be as successfully operated on systems of two, three or more phases as on an ordinary single phase circuit, provided equal pains be taken with the distribution of copper in the lines and the regulation of the voltage at the dynamos. If these conditions are observed, a two-phase circuit with separate wires acts substantially as if it were fed from two ordinary alternating dynamos. A triphase circuit gives a similar result, and if more phases were concerned, the same would be true. If the condition of constant voltage at the center of distribution be fulfilled, as it can be and must be for successful operation on any system whatever, two and three phase incandescent lighting systems can and do work admirably. Furthermore, if we combine circuits, for example, if we use but three wires instead of six for the three-phase system, there is no exact equality of balance required between the lamps placed in different connections across these circuits. On the three-phase system we would place lamps between each possible pair of the three wires, this arrangement gaining, as I before mentioned, in copper wire enough to compensate for the slight inconvenience in connecting three sets of lamps instead of one or two. Branches can be run from any two wires of the triphase arrangement, and lights placed on them will act exactly as if they were placed on any ordinary alternating circuit. With such an arrangement you should be able to throw off all the lights on one side of the circuit, without producing any noticeable variation in the lights of the other two branches—no more variation for example than you would get if, on a given set of secondary mains from a common transformer, you were to turn off or turn on one-third of the total number of lights. If any man comes to me and says that a three-phase system will not run lamps successfully, unless there is careful balance between the lights on different sides of the circuit, I have in that statement sufficient evidence to convict him either of ignorance of the principles of wiring and dynamo regulation, or of willful misrepresentation of the facts. I lay stress upon this matter of incandescent lighting in defense of multiphase systems, because it is the one upon which they have been most often misrepresented, chiefly through foreign experiments, which I do not hesitate to denounce as clumsily conducted.

In taking up the condition I have just mentioned, that of new centers of distribution, I may briefly refer to the properties of multiphase motors, which have been the subject of all sorts of curious mis-statements. A multiphase motor, I do not care whether it has two or more phases, should, if properly built, have very nearly the properties of a good shunt motor, and not far from the same efficiency. Incidentally, it has the advantage of having no commutator, and no necessity for any moving contacts. It starts under two, three or more times the running torque, just as a shunt motor does, and by virtue, if the torque is extreme, of a heavy starting current just as a shunt motor would. It comes rapidly up to a nearly fixed speed, and remains nearly at that speed under variations of load. If overloaded it stops, like any other motor. In addition, it has one great merit that shunt motors do not have, that of running at nearly constant speed independent both of load and moderate variations in voltage. It is, on the whole, less thin-skinned than a shunt motor. I have experimented with a considerable number of multiphase motors of the induction type, to which I here especially refer, and although I have seen some terribly severe tests in the way of overload, I never yet saw any symptoms of a burn-out. The efficiency of these machines should be, and is, at least, within a per cent. or two of ordinary shunt motors.

There has been much discussion as to the relative merits of two and three-phase induction motors. In general the more phases the smoother action of the machines in various respects. I have never yet seen a two-phase motor any better than a three-phase motor. I should want a pretty careful series of tests to convince me that I had seen any one as good. The difference between them, with proper design, ought not to be very great, though the three-phase has the advantage in cost of wire. There are two important points in which multi-phase motors have been misrepresented, which I should like to mention.

First, it has been stated of them that they take an enormous current when running light, and second, that they introduce a very large and most objectionable lag in the circuit, so that the apparent current on the line is much greater than the energy current. Such facts have, doubtless, been observed. Broadly speaking, they have been due to faulty design. A multiphase motor will always take a somewhat larger current when running idle than the corresponding direct current motor, but it takes very little more energy, as the phenomenon of lag then becomes noticeable, so that of the apparent current running light, only a portion represents energy. It is a perfectly simple matter to cut down the current required by a multiphase motor running idle to 20 or 25 per cent. of the full load current required by a motor excellent in its other properties. As motors where power is sold by meter are usually cut off when not needed, the whole question of this idle current sinks into insignificance. The same is true of the alleged lagging current. If a multiphase motor (I speak with certainty, at least, regarding the three-phase), of 10 or 15 horse-power, should show at full load more than 10 or 12 per cent. of lagging current, I should consider it to be badly designed, so that these two questions of so-called idle current and lagging current, as disturbing factors in a multiphase line, can be and are reduced, by proper care in designing, to comparatively insignificant quantities. It has been very ingeniously suggested to give them a further shove down into oblivion by means of condensers, but it is a commercial rather than an electrical question as to whether leakage current and lag had better be thrown quite into the abyss by the added complexity of condensers or left hanging on the ragged edge without them.

In case, then, of working a central station from a distant water power, where necessity for extensions or new centers of distribution exists, we have plenty of methods available. Triphase direct current transformers for railway and direct current lighting service, alternators to feed into the existing mains or to supply extensions for them and for new centers, which light alone is to be employed, ordinary alternating currents; or where both light and power are necessary, multiphase apparatus, which, as I have shown, is entirely applicable for such a mixed system.

I may add that there is a possibility that we may have before long practicable motors to run on an ordinary alternating circuit constructed after such methods as were suggested by Prof. Thompson a few years ago. In very small sizes they are already practicable. Brown, abroad, has been making a desperate effort to exploit these very methods on his own responsibility and has obtained motors which run successfully, but as yet do not start well under load. From what I can learn of them, I doubt very much if they are any improvement on the motors of the same type shown

by Prof. Thompson at the Paris Exhibition, or on Mr. Tesla's motors for running a two wire circuit.

Whatever the methods which may be employed, several serious questions must be confronted when one attempts to transmit power for supplying central station or any other apparatus. One of those which presents itself immediately is whether or not, in an alternating transmission, it is advisable to use step up and step down transformers. The principal determining factor in this is cost. The higher voltage we can supply direct from the machine without increasing its cost considerably the cheaper we can make the installation. Unfortunately, in building dynamos, the armature coils have to be insulated, and, where the voltage is very high, the insulation is correspondingly thick, so that with a given amount of material we must, in building a high voltage machine, take up with insulation the space which would otherwise be available for copper. The result is that a dynamo wound for 4,000 or 5,000 volts is intrinsically more expensive, unless the size be very large, than a machine wound for 1,000 or 2,000 volts, besides being considerably less reliable. Machines of such voltages as these have been built in this country and abroad, and some of them have given very fair results, but they are expensive to manufacture at whatever prices they may have been sold in individual instances, and it is my personal opinion that where it is necessary on the score of economy to raise the voltage as high as 4,000 or 5,000 volts, it is better and cheaper, unless the units be very large, to use step up transformers and carry the voltage up to 10,000. Assuming 2,000 or 3,000 volts as the available potential obtained from the machine direct, and then estimating the cost of a given installation, first using these machines, and second using low voltage machines with step up transformers, we find that at prices ordinarily charged for apparatus and copper, the two methods become of equal cost at a distance of somewhere about seven or eight miles. Above these distances, the step up transformers cheapen the plant, below it they increase the expense. We can draw the line at no specified given distance for the general case, but can very easily for any specific case.

The amount of drop advisable in these long distance lines will depend, of course, principally upon the relative prices for copper and the apparatus necessary. If copper be relatively cheap, it pays to employ a good deal of it. If apparatus is relatively cheap, it is better to use larger generators and allow more drop on the line. 15 to 20 per cent. will suit the large majority of cases on the score of economy and convenience. It should be remembered, however, that for such drops as these, good regulation is most essential, but good enough is available with direct, alternating or multiphase machines, to make these drops thoroughly practicable. The approximate figures I have just given on the limitations of the step up transformer and on drop are the result of the investigation of a large number of concrete cases which I have had occasion recently to examine in detail and for a number of which the apparatus is now in process of manufacture. I, therefore, feel personally convinced of their practicability, both theoretically and otherwise.

But for the central station man who desires to decrease his operating expenses by the employment of electrical transmission the court of last resort is the balance sheet, and the fundamental question is, "Agreed that it is practicable, will it pay?" I can give no general answer to this question, for each problem necessarily must be considered by itself. It is possible to formulate equations which will connect all the variable factors of cost and annual charges, so as to enable one to derive from them an answer to this all important question. But the character of such formula is necessarily so complex, and involves so many quantities, that it is generally easier to take a short cut to the result by making a few approximate estimates. I have, however, looked into the profit and loss probabilities of a large number of plants of all descriptions and in a general way one can say that power transmission to a central station will, unless the cost of developing the water power be very great, almost universally pay at distances of 10 or 12 miles or less. It will frequently pay up to 20 or 25 miles. Now and then, under extraordinary conditions (very expensive coal and very cheap water power), up to 40 or possibly even 50 miles. In using alternating currents at these long distances one naturally fears the effects of inductance in the lines and of static capacity. In very long lines operated at high frequency, these difficulties may rise to formidable magnitudes. Knowing the dimensions of the line, the frequency and the currents, it is, however, possible to calculate the effects of these disturbing elements with great accuracy. From these calculations I feel safe in saying that within the distance mentioned inductants and static capacity constitute no serious obstacle to success, if the frequency employed be moderate; such, in other words, as one would be led to select in considering the operation of motors alone. Large generators are as readily and nearly as cheaply built for frequency of 50 or 60, as for higher ones; sometimes more easily under these circumstances, I think cases would be rare, where transmissions, the advisability of which would be dictated by commercial consideration, would encounter serious difficulty from inductants and capacity. I have never personally investigated a proposed transmission of over 50 miles that gave any promise whatever of financial success, but the time may come when such a case will appear, and if it does, the work can be done successfully, so far as the electrical part of the matter is concerned. I think the greatest difficulty in surmounting long distances is the difficulty of keeping a long line in proper repair. Eternal vigilance will be the price of success in this respect, otherwise there is little trouble. The apparatus is thoroughly reliable and efficient, and the methods comparatively straightforward and simple.

Throughout this discussion I have taken the position that no one method of procedure is applicable to all cases. Personally, I am decidedly eclectic in my taste, believing that it is better to put in for each individual case such apparatus as on the whole proves to be cheapest and best, rather than to advocate, on any fine drawn theories, methods which might be applied to the perfectly general case of transmission of power. It is the concrete rather than the abstract that we have to consider when proposing apparatus on which the success of large commercial affairs depends, and although some methods are better than others, it is well to remember that, while the electrical pharmacopœia may have its calomel and paregoric, it contains no elixir of life.

A New Double Pole Snap Switch.

A snap switch of entirely new design, which owes its creation to the General Electric Company, is illustrated herewith. The distinguishing feature is the ratchet piece, which has four steps arranged in quadrants on both the upper and lower sides and revolves horizontally, two large and two small. One or these ratchet steps is covered with a copper strip passing across the porcelain to the corresponding step on the other side of the ratchet block. Two contact strips of hard spring copper, placed opposite to each other, top and bottom on either side, bear upon the copper pieces on the ratchet when the circuit is completed. When the ratchet is revolved, the copper spring pieces are slowly forced apart until the crest of the steps is reached, when they spring to the uncovered steps or quadrants instantaneously, rendering arcing impossible, and placing between them a barrier of porcelain insulation. A similarly forward movement instantaneously makes the circuit. The arrangement is similar to that in the ordinary plug switch, in which a solid mass of metal is inserted between contacts, and the circuit broken by its removal. In this

New Double-Pole Snap Switch.

switch the metal plug is withdrawn and instantaneously replaced by a porcelain plug. By the peculiar formation of the ratchet and the length of the copper brushes it has been found that the latter do not acquire a permanent set, even after long use. These switches are made in the double pole variety only, and are of the two patterns, the ordinary type, and the flush pocket style. The latter is adapted to insertion in wall pockets, and is then furnished with a decorative wall plate. They are designed in capacities of 10, 25, 40 and 50 amperes.

The annual meeting of the Consolidated Telegraph and Electrical Subway Company, held in New York city on February 28, resulted in the election of all the old directors.

A New Lever Switch.

The General Electric Company has just put upon the market a feeder switch in which the solid contacts are rigidly mounted on the base, and the clips operated by the handle come down one on each side of the contact piece. The switch is so designed as to have all contact surfaces true, this being effected in one operation upon a machine especially devised for the purpose. The soldering of the clips into the lugs is done away with, the lug and contact pieces being one homogeneous piece. The parallel clips are hinged to one contact piece, and are also securely riveted to a piece of metal

A New Lever Switch.

half way between the hinge and making end. To this piece is fastened the handle, which projects upward, and then forward at an angle of about 45 degrees.

The most valuable characteristic of this switch is an almost perfect contact surface, having a low co-efficient of friction, with high conductivity, the two surfaces acting as if lubricated, minus the additional resistance of a lubricator. The split blade descending on the contact pieces, yields uniformly, and thus makes an ideal contact.

The device by means of which the circuit is suddenly broken is an innovation. It consists of a short brass bar fastened on the under side of the switch blades, one end pivoted near the middle of the blades, the other being held by a spiral spring, while on the side of the contact post facing the hinge of the switch is a small projection. As the switch is opened, the end of the small bar catches on this projection, and thus remains in full contact until after the blades have entirely left the contact post. When the switch is well opened, the bar slips off the contact post, and is drawn by the spring to its original position against the blades of the switch. By means of this ingenious device a sudden break is obtained, and as the connection is unbroken until after the blades have left the contact piece, the contact surfaces of the switch do not suffer from arcing—two features of especial advantage in switches of this character. These switches are designed for use on circuits of a potential not exceeding 500 volts, and are made in capacities running from 30 to 1,500 amperes.

TELEPHONE CHAT.

The House of Representatives passed a bill establishing maximum telephone rates at $50 per year in cities of over 100,000 inhabitants, $40 between 30,000 and 100,000 inhabitants, and $30 in all other cities of the State.

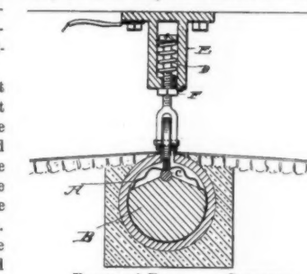
The Pulsion Telephone Company, of West New York, recently incorporated, expect to operate in Erie, Niagara, Chatauqua and Cattaraugus Counties, the telephone lines to be private and not connected with any general office.

Mr. L. E. Ingalls, of Chicago, has been appointed a committee of one by the directors of the Harrison International Telephone Company, to have charge of selecting a site for a building which is intended to be used as a manufactory for their instruments.

At the annual meeting of the Bell Telephone Company, in Montreal, all the officers were re-elected. The following figures show the prosperous condition of their affairs: Gross revenue for the year, $875,526.44; expenses, $655,139.81; net revenue, $220,386.63; paid-up capital, $2,200,000.

A Water-Tight Railway Conduit.

An interesting and novel invention has been made by Mr. Frank C. Perkins, who will be remembered as a contributor to the Electrical Review, designed to promote the successful application of an underground or conduit system of electrical supply for electric railways. Mr. Perkins' idea embodies simply a metallic tube completely closed along the entire length of the railway, in or under ground, in which tube is mounted upon insulating supports the supply conductor. The tube is made sufficiently thin, so that a car passing along the line of way and provided with a pressure wheel, may force the top of the tube into metallic connection with the conductor and thus afford a continuous supply of current. One form of the invention is illustrated in the accompanying engraving, wherein is shown, at A, a tubular shell substantially circular in cross-section and preferably corrugated at the top, so as to produce increased flexibility, within which tube is mounted upon an insulating support a supply conductor *c*. The tube may, if desired, be filled with oil. The car which passes over the conduit is provided with a presser-foot F, shod with a wheel or roller which bears upon the tube or shell and forces it at the point where the car happens to be into electrical contact with the supply conductor *c*. As the car proceeds along the line of way the tube is depressed momentarily into contact with the conductor, and after the car passes it springs away by its own elasticity and leaves an air or oil space between the conductor and the shell. For purposes of stability or strength and protection from corrosion, the metallic shell will be enclosed in a terra cotta or some other suitable envelope, which may be mounted in concrete



Perkins' Railway Conduit.

or supported in position along the line of way in any other suitable way. The tubular shell will preferably be formed in sections rigidly secured together by a slip joint and insulated from one another. It is not absolutely essential that the tube sections should be formed in a single piece, although this is the preferred form of construction, as it absolutely prevents the entrance of dirt or water, and, therefore, prevents the leakage of current from the supply conductor. The essential feature is that the conductor shall be enclosed in a water-tight metallic envelope, the top or face which engages the traveling contacts being sufficiently flexible and elastic to spring back from the supply conductor after having been forced into contact by the car, and the face presenting a continuous metallic contact surface.

This interesting invention would seem to open the way for the commercial application of conduits in systems of current supply for electric railways. The difficulty heretofore experienced with such systems is that they are eventually rendered inoperative by reason of the entrance of dirt or water, which results in short-circuiting the current, and either totally disabling the system or creating such a great amount of leakage as to render its operation commercially unprofitable. In Mr. Perkins' system the conductor is in a water-tight envelope of complete metallic integrity throughout the entire route, and if the tubular shells contemplated by the invention can be made to yield the efficient service claimed for them by the inventor, the system promises to be one of great commercial importance. It will enable a conduit system to be laid down comparatively cheap, and will, of course, dispense with the overhead system of supply so widely objected to on account of its alleged architectural deformities.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 3389. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITORS:
STEPHEN L. COLES.
ROBERT H. READ.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

"1546 CORTLANDT." TELEPHONE CALL.

BOSTON OFFICE:
H. G. TUCKERMAN, Room 29, 620 Atlantic Ave.

CHICAGO OFFICE:
MERWIN J. BULKLEY, 435 "The Rookery."

WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.

ADVERTISING DEPARTMENT,
H. T. RICHARDS, Manager.

PATENT BUREAU,
ROBT. H. READ, Manager.
Patents procured in United States and all foreign countries. Searches, Investigations and Reports on Validity and Infringement.

SUBSCRIPTION TO THE ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 6.00
Single Copy, - - - - - - - .10

NEW YORK, MARCH 18, 1893.

CONTENTS.

	PAGE
Views, News and Interviews	57
General T. T. Eckert	57
Thermal Storage for Central Stations	58
Literary	58
Attraction of a Hemispherical Shell on a Unit Quanity of Matter at its Center	58
An Accurate Meter for Alternating Currents	59
Electric Railway and Power Notes	59
Street Railway Legislation in Pennsylvania	59
The Telegraphic Tournament	59
The Storey Motor	59
Power Transmission for Central Stations	60
A New Double Pole Snap Switch	61
A New Lever Switch	61
Telephone Chat	61
A Water-Tight Railway Conduit	61
The World's Fair	62
Letters from a Laboratory	62
Correspondence:	
Our Boston Letter	63
Our Chicago Letter	63
American Institute of Electrical Engineers	63
Personal	63
Obituary	63
Mr. Hammer Corrects His Discussion	63
Another Man	63
News Notes	63
Incandescent Lamp Matters	63
The REVIEW of February 25	63
The Wizard's Pantheon	64
A Sub-lunar Luminary	65
Convention Attendants	66
Advance Information	67
Electric Light Flashes	67
Kindred Interests	68
The MacKaye Spectatorium	68
St. Louis Convention Notes	68
Electrical People at the World's Fair	68
General Notes	68
Electrical Patents	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
American Electrical Works, insulated wire	i
Ansonia Brass & Copper Co., wire	xvi
Armington & Sims, engines	xvi
Babcock & Wilcox Co., boilers	xvi
Beatey, Geo. A., engines	i
Bliss Co., E. W., drop hammers	i
Brush Electric Co., apparatus	xv
Campbell Electrical Supply Co., insulating tape	i
Crocker-Wheeler Motor Co., motors	i
Day's Kerite, insulated wire	i
Dwight Slate Machine Co	xvi
Eastern Electric Cable Co., insulated wire	xvi
Eddy Electric Mfg. Co., motors	i
Faraday Carbon Co., carbons	xvi
Hampson & Co., P., engines	xvi
Jewell Belting Co., belts	xvi
Massachusetts Chemical Co., insuliac	i
Mather Electrical Co., power generators	i
Moore, Alfred F., wire	xvi
Noye Mfg. Co., John T., engines	xvi
Okonite Co., insulated wire	i & xvi
Otis Bros. & Co., elevators	xvi
Paine & Ladd, patent attorneys	i
Rhode Island Tool Co., tools	xvi
Riker Electric Motor Co., motors, dynamos	i
Simplex Electrical Co., insulated wire	i
Waterhouse, Gamble & Co., arc lamps	i
Westinghouse Electric & Mfg. Co., electrical apparatus	ii & xv
Weston Engine Co., engines	i
Wilmot & Hobbs Mfg. Co., bell gongs	xvi

INSIDE PAGES.

Alexander, Barney & Chapin, sal ammoniac	viii
Allis & Co., Edward P., engines	xi
American Bell Telephone Co	vi
American Fluoride Co., fluoride	xi
Baker & Co., platinum	x
Ball Engine Co., engines	x
Ball & Wood Co., steam engines	ix
Barrett, John A., electrical engineer	x
Berlin Iron Bridge Co., iron roofs and buildings	iv
Bickford & Francis Belting Co., belts	ix
Billings & Spencer Co., wire cutter	68
Bishop Gutta Percha Co., insulated wire	ix
Blaisdell & Co., tools	xi
Boston Gear Works, gears	ix
Brill Co., J. G., tramway cars	xiii
Brown Electric Co., electrical supplies	vii
Buckeye Engine Co., engines	iv
Butler Hard Rubber Co., hard rubber	x
Carpenter Enamel Rheostat Co., rheostats	xi
Central Electric Co., supplies	vii
Chicago, Milwaukee & St. Paul Railway Co.	xiii
Church & Sleight, tools and supplies	iv
Crocker Electric Co., arc lighting	xiii
Conover Mfg. Co., condensers	xi
Cowles Electric Smelting & Aluminum Co., aluminum	68
Cutter Electrical & Mfg. Co., reflector shade	xiii
Cutter, George, electrical supplies	viii
Dixon Crucible Co., belt dressing	xiii
Dunderdale, F. C.	xiv
Edison Decorative and Miniature Lamp Department, incandescent lamps	68
Electric Construction and Supply Co., Ward arc lamps	iii
Electric Secret Service Co., cut-outs	xiv
Electrical and Mechanical Engineering and Trading Co., contractors	vii
Electro-Light Engraving Co., engraving	xiii
Elektron Mfg. Co., electric motors	viii
Empire China Works, porcelain specialties	xiv
Falls Rivet & Machine Co., friction clutches	xi
Garvin Machine Co., tools	xi
General Electric Co., inc. lamps	v
General Incandescent Arc Light Co., arc lamps	iv
Gleason Manufacturing Co., E. P., electrical appliances	xiii
Goodyear Hard Rubber Co., hard rubber	x
Greeley & Co., The E. S., supplies	vii
Harrisburg Foundry & Machine Works, engines	iv
Holman Electrical Co., reflector shades	xiii
Holmes, Booth & Haydens, insulated wire	vi
Hulbert Fence and Wire Co	xi
Interior Conduit and Insulation Co., fan and motors	viii
Iron Mountain Route	68
Johns Mfg. Co., H. W., vulcabeston	viii
Lake Co., J. H. & D., pulleys	xiv
Leclanche Battery Co., batteries	ix
Lehigh Valley Creosoting Co., creosoted lumber	68
Leffel & Co., James, water wheels	vii
Marshall, Wm., condensers	x
May Bros	ix
National Electric Mfg. Co., dynamo electric machinery	xiv
National Pipe Bending Co., feed-water heater	ix
New England Butt Co., braiding machinery	xiv
New Jersey Lamp & Bronze Works, electric and gas fixtures	ix
Newton Rubber Co., hard rubber	iv
New York Belting and Packing Co., rubber belts	xiii
New York Insulated Wire Co., wires and cables	xiv
Onondaga Dynamo Co., electrical apparatus	vii
Ostrander & Co., W. R., supplies	xiv
Palmer Bros., engine castings	68
Partrick & Carter Co., electrical supplies	x
Penn Life Co., insurance	68
Phœnix Glass Co., glass globes	vi
Phosphor Bronze Smelting Co., castings	vii
Queen & Co., electrical instruments	x
Railway Equipment Co., elec. r'y supplies	vi
Reed & Co., F. E., lathes	iv
Rhode Island Tool Co., tools	xiii
Ridlon & Co., Frank, general machinery	iv
Ries Electric Specialty Co., regulating socket	xiv
Robinson & Orr, steel rails	68
Rosenbaum, Wm. A., patent attorney	x
Royce & Marean, electrical supplies	xiii
Russell & Co., steam engines	vii
Schuyler Electric Co., arc lighting	vi
Shawmut Fuse Wire Co., fuse wire	xi
Shoemaker, Homer, attorney and counselor-at-law	68
Siemens & Halske Electric Co., electrical machinery	iii
Standard Paint Co., insulating compounds	xi
Stocking, E. B., patent attorney	x
Tyndall, Wm. D., attorney	x
Underwood Mfg. Co., cotton leather belting	iii
Walworth Mfg. Co., trolley poles	iii
Washburn & Moen Mfg. Co., wire	x
Western Electric Co., supplies	vii
Wilson, Fremont, electrician	x

It is predicted in Boston that the Beacon lamp will be manufactured by the company under a license from the General Electric Company. This would please Mr. T. Carpenter Smith.

"Your Souvenir number is indeed a beauty of typographical work and skillfully collected reading matter," writes Victor M. Berthold, of Boston. Mr. Berthold is with the large majority in this opinion, as the great many similar compliments received at this office satisfactorily prove.

The Press Club Fair, which is to be held in New York during the month of May, will have many special features, but none will be more ornamental or attractive than the electrical exhibit which, it is expected, will include an electrical fountain to be designed by a prominent electrical engineer.

It has come at last. There is in operation in the street cars of Albany, N. Y., a device for communicating to passengers the names of the streets as they are passed, and thus save the perpetual opening of the door and the bawling of the conductor. An indicator is worked automatically from the trolley line, and consists of a set of tablets having printed upon them in prominent letters the names of the cross streets. Before the arrival of the car at the street the new name is exposed and a bell is rung. When the car reaches the end of the line, the mechanism is reversed and the signs are shown in their regular order. Why is not something like this done in this city? Albany has started the ball a rolling, let each one of us give it a little push.

Gen. Thomas T. Eckert was the logical successor to Dr. Norvin Green, the deceased president of the Western Union Telegraph Company. Years of experience, great force of character and a pleasant nature particularly qualify Gen. Eckert for this additional responsibility. The REVIEW congratulates both the new president and his company.

The New England *Courier*, the German-American weekly of Boston, recently issued a particularly interesting edition which contained an elaborate account of the opening of the Boston-Chicago telephone line. Editor Berthold is to be congratulated over the excellent illustrations and interesting reading presented in this issue—and for that matter the *Courier* every week is a number of which any editor may feel proud.

Good fortune is again on the side of the American Bell Telephone Company. Senator Dixon, chairman of the Senate committee on patents, has declined to introduce the bill prepared by the department of justice asking that precedence be given by the United States Circuit Court in the case of the United States against the American Bell Telephone Company and Emile Berliner. The senator's refusal is said to rest on the ground that it would be an act of discourtesy to the court. This is the case mentioned by Mr. Grosvenor P. Lowrey in his interesting article published in the REVIEW, February 25.

Although no accurate statistics have been kept of the marriages of the female operators in telephone exchanges, it is roughly estimated by the manager of a Western office that about 12 per cent. of the girls marry every year. He says that by long practice some of the telephone girls acquire a most captivating tone in inquiring "what number," and they learn patience and gentleness by the rigid rules of the office. Business men who watch these things and young men who are looking for wives with pluck are not slow to "catch on." This is a large percentage, and the advice to elderly females is obvious. Now, gentlemen of the telephone companies, be prepared for the rush.

It seems that there is a decided necessity for some automatic electrical device for indicating the next station on our elevated railroads. On one road in Brooklyn some of the guards seem to take a pleasure in mumbling the name of the station in some secret language, the key to which they alone possess. If they see a stranger on the lookout for the station of his destination they fairly hug themselves with suppressed anticipated delight, twist their tongues into inconceivable knots and finally burst forth with some murmur, all of which seems to be a secret between the guard and the gate-post. Come, let a bright inventor substitute some electrically controlled indicating device for the inefficient guard, and relieve many already overworked minds of the strain consequent on looking out for the next station.

THE WORLD'S FAIR.

While there may have been some just cause for complaint against the World's Fair management, the great majority of such cases are due to the unexpectedly large demand for space on the part of exhibitors that came after the plans for the Fair had been entered upon.

The Editor of the REVIEW recently visited several of the officials in charge of the different departments, and was informed that the requests for space were many times more than the buildings would hold. As a natural consequence there were some disappointments.

In the building devoted to electricity the space is all allotted and several of the exhibits under way. Chief Barrett and his energetic and obliging assistant, Secretary Hornsby, have been particularly earnest in their efforts to properly provide for the great electrical industry, and we are quite confident their efforts will result in substantial success.

LETTERS FROM A LABORATORY.—XXXVI.

BY JULIAN A. MOSES.

The introduction of the hektograph, mimeograph and numerous other devices and processes for the making of a limited number of reproductions of drawings or manuscript, has superseded to a great extent the more expensive printing where few copies are wanted, not because the latter is not far better, but because of the many facilities which the former methods allow of. Time is saved by their use and what is termed amateur work can be accomplished to great advantage. The initial expense of this kind of apparatus often prevents its adoption. The fact that the devices are patented, for the inventors have recognized their worth, enables the manufacturer to make considerable profit. Large numbers of them are sold and their use is almost universal where they are required. The hektograph is a most excellent device and its working depends on the facts that a pad of prepared gelatine has the power of retaining upon its surface an impression of any aniline ink, and that this aniline ink never thoroughly dries and is able to be subdivided a great number of times. One of these gelatine pads, of sufficient size for laboratory use, would cost the experimenter somewhere in the neighborhood of five or six dollars, a price utterly inconsistent with the value of the time and materials used in its manufacture.

The principle upon which it operates is simple. The original writing is done on a glossy paper and is pressed upon the gelatine pad, which retains some of the aniline ink, forming thus a negative, from which reproductions of the original may be made by pressing other pieces of paper upon the surface of the pad and removing them with a portion of the ink.

The following is a recipe which has been found to work very successfully, and will serve as a substitute for the patented article for those who are not desirous of spending that sum of money as an outlay. Swell one ounce of good cooking gelatine in enough water to completely submerge the mass. In order to melt this moistened gelatine, a temperature of about 100 degrees C. is necessary. This may be obtained by using as a source of heat a bath composed of a boiling saturated solution of borax or common salt. Over this bath warm some pure glycerine to about 90 degrees C. The excess of water must now be poured off from the gelatine. Put the swelled mass into the heated glycerine, set it on the bath in a suitable porcelain or glass vessel, and allow it to heat for about two hours. An intimate mixture of the two solutions must be obtained, and this necessitates constant stirring, with due regard to the avoidance of all bubbles of air or steam. The mass before pouring must not be too "ropy," nor must it be too thin, but when a small portion of it is dropped into a vessel containing ice cold water, it will be of a tough and gummy consistency.

To prevent decomposition about 10 drops of oil of cloves or any other antiseptic should be incorporated with it. A suitable pan should be provided into which the composition is to be poured. A flat, rectangular shallow pan being the most suitable. The layer should be about three-eighths of an inch in thickness. While it is cooling, all bubbles as they form should be pricked with a pin, while the pan should be placed in a perfectly horizontal position so as to obtain a level and even surface.

It is very difficult to get the exact proportions in this composition, but another formula almost as satisfactory and easier to work is made as follows:

Barium Sulphate (powdered)	1 part.
White Glue	4 "
Glycerine (Price's)	21 "
Water, distilled	16 "

These proportions are the result of a great deal of experimenting and should be closely followed. Naturally the temperature of the atmosphere changes and it is almost impossible to give exact figures, for they vary for the different seasons of the year.

Where reproductions from type-written copy are desired the Edison mimeograph is excellent, but those type-writers which are supplied with ribbons will not work as satisfactorily as those that are furnished with a self-inking pad, such as the Yost machine. By using a copying pad on the typewriter in conjunction with the hektograph, reproductions may be obtained that are in a measure suitable, but not as satisfactory as those obtained by writing with a pen supplied with a good aniline ink.

CORRESPONDENCE.

OUR BOSTON LETTER.

The Bradbury-Stone Storage Battery Company, of Lowell, Mass., are meeting with great success with their "Ideal" battery, and are running to the full capacity of their plant. They are still considerably behind in their orders, and are contemplating an extension of their present facilities in the near future.

The Dartmouth and Westport Street Railway Company have been granted a franchise by the town of Dartmouth, Mass., for the construction of an electric road between New Bedford and Smith Mills. The road is to be completed between these points by July 1, and the company are under $10,000 bonds for the fulfillment of this agreement.

The New Steel Foundry of the General Electric Company at Lynn, Mass., which is the largest plant of this kind in the country, was started last week in the presence of a number of invited guests. The foundry is situated almost on the spot covered by the first plant of the kind to be established in America, and which was in operation over a hundred years ago. It is fitted with every modern appliance, and the mechanical arrangements are as near perfect as it is possible to get them. When in full blast the foundry will have a capacity of 30 tons of steel casting per day.

The Clinton Street Railway Company, of Massachusetts, have obtained a franchise from the selectmen of that town for the construction and operation of quite an extensive local and suburban system. The new company has a capital of $30,000, and E. C. Swift, of Chicago, owns a controlling interest. The capital will be very largely increased at once, as it is proposed to build over ten miles of road, the construction of which will cost in the neighborhood of $7,000 per mile. Operations will be commenced at the earliest possible moment, and the road will be completed November 1.

L. J. Hurt, of the West End Company, and Engineer Lyman, of the Lowell Street Railway Company, have been appointed to examine into the cause of the recent accident at the power station of the latter company, which resulted in so much damage from the bursting of the fly-wheel of their large engine. This has been an unfortunate winter for the Lowell Company, there having been a series of accidents from one cause or another which have seriously interfered with traffic and also caused them heavy pecuniary damage. It is hoped that the inquiry may tend to demonstrate where the fault lies, and diminish the liability of similar occurrences in the future.

The Annual Entertainment of the Boston Press Club was held at the Boston Theatre on the afternoon of Thursday, March 9, and was in every respect an artistic and financial success. The immense theatre was crowded from pit to dome by a most appreciative audience, who were treated to a solid five hours of entertainment such as it is seldom possible to witness. The greatest enthusiasm prevailed among those interested in making it a success, and the newspaper men of Boston are to be congratulated on having such a host of friends. The Press Club were able to make an entry of $4,000 on the credit side of their ledger as a result of the afternoon's work. H. G. T.

Boston, March 11.

OUR CHICAGO LETTER.

Mr. A. M. Morse, St. Louis representative of the Buckeye Engine Company, was in Chicago last week.

In the Specifications for the electric plant for the Congress Hotel, the new annex to the auditorium, Okonite wire has been named.

Mr. A. M. Walter, lately at the Lynn works of the General Electric Company, is now connected with the arc light department of the World's Columbian Exposition.

Mr. J. E. Zeublin has been appointed general superintendent of the Chicago Telephone Company. His office is Room 21, Telephone Building, 203 Washington street, Chicago.

George Cutter, who was suddenly taken ill on the train on his way to the Convention at St. Louis, has recovered, and left for New York yesterday, where he will start his new factory for the manufacture of enamel rheostats, so as to take care of the large orders already booked by him.

The Electric Appliance Company announce that they have taken the Western agency for the celebrated O. K. weather-proof house, line and feeder wires, and will carry a large and complete stock in Chicago. The quality of the O. K. products is favorably known. The Electric Appliance Company report that business is already beginning to open up on the Meston alternating current fan motor, and that they have already closed a number of agency arrangements and entered some very large orders for fan motors. The Meston motor is so well known that applications come in from every part of the country, and the Electric Appliance Company plan to have a good live agency thoroughly established in every large town having an alternating plant before the fan season begins. This agency is a valuable one, and the applications are numerous.

Chicago, March 11. M. J. B.

American Institute of Electrical Engineers.

At the seventy-third meeting of the Institute, held on January 17 last, Mr. Caryl D. Haskins read a paper on "Electrical Recording Meters," which has already appeared in the ELECTRICAL REVIEW. The discussion was quite lengthy, and was participated in by Messrs. Townsend Wolcott, Fred. W. Tischendoerfer, A. E. Kennelly, C. R. Van Trump, J. Overbury, Caryl D. Haskins, and the chairman, Mr. T. D. Lockwood.

At the seventy-fourth meeting of the Institute, on February 21, Mr. Chas. Proteus Steinmetz read a note on "The Disruptive Strength of Dielectrics," in which some interesting experiments were detailed. Mr. Carl Hering also read at this meeting a valuable paper on "The Most Economical Age of Incandescent Lamps," which contains much of interest to central station men.

Owing to the pressure on our columns, due to the great mass of the St. Louis Convention report, Institute matters have been crowded out. These papers will be published, however, at the first opportunity.

PERSONAL.

Mr. W. S. Andrews has resigned his position of general superintendent of the works of the Canadian General Electric Company, Limited, at Peterborough, Ont., Canada, to assume the management of several large electric light and power concerns in Pennsylvania. His experience in this business dates from 1883 when, in connection with Mr. Frank J. Sprague, he put in the first Edison three wire central station plant at Sunbury, Pa., and since that time a great number of Edison light stations have been installed and started under his supervision, among which may be mentioned Harrisburg, Williamsport and Lancaster, Pa., Rochester, N. Y., New Orleans, La., Chicago, Ill., and Minneapolis, Minn. Mr. Andrews began his electrical career with Mr. Edison at Menlo Park, in 1879, and ever since that date he has been intimately and constantly connected with the manufacture, setting up and running of electric light and power machinery. His long training in these fields of work will be of especial value to him in his new position.

OBITUARY.

Arthur B. Stillman, an electrician employed by the Brush Electric Light Company, of Rochester, N. Y., while replacing carbons in a commercial arc lamp on March 10, was killed by an electric shock. The current was not entirely cut off. He supposed it was, and, taking hold of the lamp with one hand and a chandelier with the other, he received the current.

D. Herbert Jeffery, secretary of the Crocker-Wheeler Electric Company, of this city, died on March 2 of pneumonia, after an illness of 10 days. Mr. Jeffery, although but 41 years old, had had a wide business and manufacturing experience. He had been secretary of the Crocker-Wheeler Company for two years past, and had shown great executive ability.

Col. Charles B. Taylor, the best known telegrapher in Kentucky, died in Frankfort, in that State, on March 11, within a few doors of the place where he began his work as a telegrapher 44 years ago. Most of those years had been spent in the peaceful, quiet, but very busy local office, but they embraced intervals of exciting experiences. He was born in Frankfort 59 years ago, and began work as a telegrapher there in 1859, and was one of the first men to join the Confederate telegraphic service, with the rank of Captain. He was one of the originators and an ex-president of "The Old-Time Telegraphers' Union," and was a close friend of Leonard, one of the first telegraphers to read by sound.

Mr. Hammer Corrects His Discussion.

TO THE EDITOR OF ELECTRICAL REVIEW:

The official stenographer who reported the proceedings of the National Electric Light Convention, at St. Louis, has made a number of blunders which appear in your edition of March 11, which I desire to correct.

On page 50 of the issue of that date I am made to quote Dr. Bell as having stated that "it is not practicable to use multiphase machines over 1,200 volts." I referred to direct current machines, not multiphase; and called attention to the fact that Professor Crocker had made the statement before the American Institute of Electrical Engineers, that he had been running for some time direct current machines of 5,000 and 6,000 volts without any trouble whatever, and was now constructing one of 10,000. Further on in the same paragraph I am quoted as follows: "I do not think Dr. Bell placed enough importance upon the application of the transformer in this country." This should read, "the direct current transformer, or motor transformer." On page 46, in my remarks upon the relative life of incandescent lamps upon continuous and alternating current circuits, I am made to state that, "it is a well known fact that an incandescent lamp will last longer at a lower rate than at a higher rate of alternation." The expression I used was, "that it is a well known fact that an incandescent lamp would last longer at a low electromotive force than at a high one."

As the statements which have appeared in the technical papers are misleading, I should be glad if you would kindly insert these corrections. Very truly yours,

WM. J. HAMMER.

New York, March 11.

Another Man.

TO THE EDITOR OF ELECTRICAL REVIEW:

In your recent publication, under the heading of "An Electrical Bonanza," you have (probably unintentionally) brought to me a notoriety which grates harshly on one of my modest and retiring disposition, and also detracts from the fame and reputation of one greater than I can ever hope to be. By the transposition of a single letter you have brought me into unsought prominence and at the same time shadowed the fame of the only man that ever "held electricity by the ear." I have been accused of "talking through my hat," in that respect and only that can I hope or aspire to resemble the "mighty W."

If you will, MR. REVIEW, kindly substitute the name of *Watkins* and let him have and enjoy the benefits of your valuable article you will confer a favor on one who is content to sit on the lowest step and wonder how these Napoleons of electricity ever reached the top rounds!

Yours truly, H. E. WILKINS.

Springfield, Mass., March 2, 1893.

NEWS NOTES.

William O. Edwards, who had charge of the telephone interests at Covington and Newport, Ky., died recently of pneumonia.

A dividend of $3 per share has been declared by the Bell Telephone Company in Boston, payable April 15 to stock of record March 31. Books close March 31 and re-open April 15.

With a single exception, all of the discharged Western Union operators of St. Paul, Minn., have been reinstated. The reasons for the discharge are given in the reinstatement. Each man on being sent to his key was required to sign the statement that he does not belong to any union, and that he will agree not to join any union in the future.

We note the following in an exchange:

Telephone connection is to be established between Dubuque and Key West. This will be of especial advantage to undertakers and others, and Manager Hoopes is soliciting contributions or guarantees from them.

What a remarkably healthy part of the country that must be! Such facilities for undertakers, too.

Incandescent Lamp Matters.

THE EDISON-BEACON CASE MAY BE AMICABLY ARRANGED—A NEW LAMP COMPANY IN HARTFORD.

Matters seem to have assumed a new phase in the Edison-Beacon lamp controversy; and it looks now as though the avowal that "the fight had only just begun" was rather ill-timed. A rumor is on foot which has emanated from a pretty direct source that a deal is about to be consummated with the General Electric Company, whereby the Beacon Company will be allowed to continue the manufacture of their lamps for sale to the General Electric Company, at 25 cents each.

This would enable them to keep their plant in operation and at the same time shut them out from competition among the general trade. This rumor, of course, cannot be verified, as neither of the parties interested have anything to say on the subject, but it seems to be in line with the previous policy of the General Electric Company, and at the same time might not be a bad arrangement for the Beacon people, as they claim to be able, by their system of manuture, to sell lamps at a profit at this figure.

It is a well known fact that negotiations of some kind were being carried on between the two companies up to within a few days of the beginning of the recent suit, and that representatives of the General Electric Company were shown over the Beacon plant, presumably with the idea of buying them out. In fact, an offer was made and rejected, and the plea for an injunction immediately followed.

Whether the present negotiations will lead to anything definite, or whether they are merely a cloak to cover some new move in the game, remains to be seen, and the further outcome is awaited with considerable interest.

Reports reach me from Hartford, Conn., that a company is being organized in that city for the manufacture of incandescent lamps on an entirely new principle. This lamp it is claimed is superior in quality and at the same time cheaper to manufacture than those built on the principle now in use. The company will be known as the Green Electric Lamp Company, and will start with a capital of $100,000. Henry Green, of Hartford, is the inventor, and Col. W. N. Woodruff, Judge W. F. Henney and Dr. G. S. Miller, are at the head of the enterprise. It is also claimed that the new lamp can be renewed any number of times at a trifling expense and by a very simple process.

Boston, March 11. H. G. T.

THE "REVIEW" OF FEBRUARY 25.

A number of highly congratulatory letters complimenting the ELECTRICAL REVIEW on its Souvenir issue of February 25, 1893, have been received at this office, and many of our esteemed exchanges have said kind words about it. We publish below a letter from a member of the house of the Partrick & Carter Company, of Philadelphia, which is typical of the many received, and which is specially prized, coming as it does from a house so thoroughly representative, conservative and long established:

PARTRICK & CARTER CO.,
MANUFACTURERS OF ELECTRICAL SUPPLIES,
PHILADELPHIA, Feb. 27, 1893.

TO THE EDITOR OF ELECTRICAL REVIEW:

Your Souvenir number just received, and I must congratulate all concerned in its publication. It is certainly far and away beyond any of the other electrical papers, and reflects great credit upon you all. It will, doubtless, be more talked about and read than any other publication at the convention.

There is one point on which I want to offer a word of praise, viz., the attractive manner in which the ads. are displayed and arranged. The REVIEW certainly has the knack of setting up its advertising pages in better shape than the other electrical journals.

I hope you may prosper to such an extent that every issue will equal the Souvenir Number.

Yours truly, C. M. WILKINS.

We are requested to state that in the article by Mr. F. H. Leonard, Jr., published last week, on "Motors for Alternating Currents," the words "two phase" should have been "single phase."

THE WIZARD'S PANTHEON.

A ROMANCE, BY J. MOUNT BLEYER, M.D.

[*Dedicated to Thomas A. Edison, the Genius of this Electrical Age.*]

There is a coldness in the way in which the earth greets the new year. True, she wears the bridal garment of white, and borrows from the North its splendid diadem of crystals, and dons all its sparkling jewels to make herself fair in the eyes of her new spouse. But her white breast is cold and her heart is hard to the new-comer, and perhaps memories of the tender, fragrant spring and of the gay burning delights of summer—past now, but not forgotten—are mixed with the sorrows of parting as resentfully she dons the pale splendors of her bridal garment and awaits the coming of her new mate and the forging of yet another link in her chain of fate. Nay, there are those who have said that the gay crystals that clasp everywhere the folds of her mantle are no other than her own frozen tears—tears wrung from the great mother in the bitterness of parting and wrought into crystals by heaven as they fell—nature's emblems of sorrow—sorrow, the great master that beautifies every noble object and ennobles every mean one. Even the brilliant heavens smile coldly upon the new year—perhaps, that in the gay mask of life they see only the mummery of death. For the stars are wise with the wisdom of fate, and in the hour of each mortal's birth and at every portentous conception of earth in letters of fire they write on the heavens the doom that hangs over man. And so, perhaps, it is only in pity, or, perhaps, it is even in contempt, that they smile so coldly always on the new year. But man heeds little these ceremonies of nature on each bridal day of the earth. He is occupied with his own cares, his own thoughts, his own enjoyments. If he heeds the cares of nature, he curses them or commends them. Then he goes his way. But on one night in the year, even he becomes grateful, and in every metropolitan city of the world, yes, even in hamlet and village and town, on New Year's eve he keeps vigil with earth. For he has his memories and his hopes, and with either he sorrows or rejoices. The new year comes in triumph, heralded by good cheer. But in no city of the world does man accept its advent so sullenly and with so little cheer as in the city of New York. In the frozen north, heaven itself is ablaze to greet the advent of the conqueror, and the hardy Northman bows to a stripling more powerful than himself. And Paris, the gayest and wittiest city of christendom—Paris the home of revelry and mirth—Paris the laughter loving—Paris that is to other cities what champagne is to other wines—Paris on the first of the year dons gala dress, dons mask and slipper, and prepares herself for rout and ball, happy to cheat time of a day; boisterous in her glee, and pirouetting on tip-toe in the very face of Time himself. And Rome! What shall we say of old, imperial Rome?—Rome, queen of the South and daughter of love and art—Rome, with her quaint streets and curious palaces—Rome that holds high carnival over the death of the old year and grows mad in her boisterous revelry ere the first sun of the new year has risen. And Venice, gay and brilliant Venice, that with mask and dance and song welcomes the new monarch for a twelvemonth, and would gladly dethrone him ere a week be past for the delight of hailing his successor. And Berlin, that pelts him with flowers and wishes him no harder fate. But New York, dull, selfish New York, that closes each door on the stranger—New York with streets generally deserted, save by hungry beggars, who ask a doler for the new year in the name of God from the passing stranger. Teeming, wealthy New York offers the new year no cheer, no Godspeed—and well earth pays the meed of surliness on her bridal eve. Sullenly she greets the great city with clouded brow, or in fury of anger lashes it with storm and sleet. Barren are the streets, no ornament even is vouchsafed to bedeck its cold stone houses and its frozen grounds. But New York rushes on heedlessly, not caring much for the new year, anyhow, and only a few of its great papers mark the event with gay stories and pictured pages, and its theatres open their doors in hopes of greater patronage and fuller tills, and a few—only a few—of its citizens keep vigil with the earth for the sake of old custom and well remembered hours. What does life hold for the citizen of the world when in New York on New Year's Eve?

It was such an evening in New York on the last day of the year 18—. There had been a flurry of snow, and now the light flakes scurried along the streets before the fierce breath of an East wind. Above, the sky was cloudless and attended by myriad stars, the moon rode majestically across the heavens. The streets of the city were almost deserted. Double rows of lights gleamed along their lengths. Here and there an electric light put the moonbeams to flight. In the cold, biting wind the warmly lighted windows of the houses on either side looked inviting. On a long block of plain brown-stone houses stretching between Fifth and Madison avenues on —— street, only one house stood out gloomily from its neighbors, dark and forbidding—it was the home of a great scientist, the inventor of wonderful electrical appliances that had done much to mitigate the sufferings of mankind, and that had made manual labor in manufactories a thing unheard of. But the man who had been able to fetter electricity and mould it to his will lived here a recluse. Few saw him, he spoke with none, except the needy and the wretched. He was generous to a fault—no human being ever applied for help at his door and was refused. He gave more than assistance, he gave sympathy and encouragement. He was loved by the poor, but he was as much pitied by them as he was loved. His older clients said that it had not always been so—that these doors had once been thrown open at the call of merriment, and that then a beautiful woman had dispensed hospitality therefrom in a princely manner. Then they whispered to the new-comer that his wife had died almost two years before, and that he had never been the same man since. Among his servants it was the same. The old housekeeper shook her head doubtfully, and said he lived only for work now—he neither ate nor slept. Then she touched her head significantly—she knew what the end must be. No man could live so and good come of it. But her fellow-servants set up a howl of derision. Was not their master the Wizard of Science—the greatest man of his age—princely in even his vagaries? Could he work wonders for the world and not know how to look after himself? The servants had great faith in their master. All this was said in the servants' hall, where a New Year's eve re-union was being held.

A bell rang. The servant called Pierre rose to answer it. He ran up two flights of stairs, drew aside a curtain at the end of the hall-way and knocked on a door. A deep voice answered "Come in." He opened the door. His master was sitting at a desk reading. He spoke quickly and nervously.

"Did you distribute the money and the clothes I gave you among the poor people as I directed, Pierre?"

"Yes, sir; they all said ——"

"Never mind that," interrupted his master, hastily.

"Have those sensitive cylinders come for me to-day?"

"No, sir."

"That's strange. They were finished yesterday." Then his brow contracted. "I can't work any more on that *fac-simile* telegraphing machine until I get them. I meant to finish it to-night."

"Hadn't you better take a little rest to-night, sir?" said the solicitous Pierre. "It's New Year's eve, sir; I'm sure ——"

"That will do; you may go, Pierre," the master spoke tersely. Still Pierre lingered.

"Beg pardon, sir; but sir, you're really over-working yourself. I'm afraid you'll make yourself sick, sir. Hadn't you better ——?"

His master smiled a strange smile—a sad, bitter smile—that seemed to say how little rest there could possibly be for him. Then he said, gently, "Go, Pierre, enjoy yourself with the rest of the house. I shan't need you again to-night."

And marveling, Pierre went down to tell his story to his fellow-servants below. To him it was a matter of mystery, how his master managed to live unless by electrical arts. "He looks uncommon bad to-night," he said, at the end of his tale. And then the servants proceeded to forget master and cares in frolic and celebration.

Certainly the master of this house, the man whom the world called the Wizard of Science and the genius of the age, was an uncommon man. As he sat now, poring over the books on his desk, he presented a strange appearance. His head was massive, broad almost to the extent of deformity, and the veins at the temples were knotted and swollen as with intense physical exertion. His forehead was of medium height, and his hair, carelessly thrown back, was of a light brown color. The back of his head was full rather than large, and sloped down to a neck that was massive without being coarse. His features were rugged, and expressed endurance rather than determination. The mouth was full and sensitive. The eyes, when he raised them occasionally from the book before him, were of a gray so deep as to have been easily mistaken for black. They were thoughtful and penetrating, and under certain circumstances might have been tender and earnest. Now they wore an intense nervous expression that might by less experienced observers have been called wild. The shoulders were slightly bent as though from much stooping.

The Wizard's dress was almost slovenly in its carelessness, and over it was worn an apron such as is commonly used by workmen. The room itself was plainly enough dedicated to science. Everywhere around it was strewn electrical apparatus. In one corner stood a bed in the shape of a lounge on which the inventor, when overpowered by fatigue, might throw himself to gain for a few hours the solace of oblivion In another corner of the room stood the writing desk at which the master was still seated reading, though with an abstracted air, as if it were impossible to concentrate his mind on the words he forced his eyes to follow. On the desk to his right, and almost under his hand, rested a small miniature, exquisite in workmanship and encircled by a row of pearls. The face was that of a woman. It was to this miniature that the master's eyes turned instinctively whenever for an instant they escaped the bondage of his will. But he immediately drew them away again and muttered, "If I can't work, I must read," and applied himself anew to his self-imposed task. The book before him was a volume of the essays of the great pessimistic philosopher, Schopenhauer.

Presently, however, a sigh escaped him, and drawing his hand slowly across his forehead, as though to free his brain from thoughts that should not find refuge there, he sank back in the depths of his chair and mused silently for some time. As the light fell full on his face, an observer could not have failed to marvel at the expression that seemed sealed on his mobile features. The expression was one of an infinite despair softened by time into a noble melancholy, and though the lips were set sternly, as if to assist endurance, there was yet so much natural sweetness mingled with the expression of melancholy fixed there that one could only feel that despair, in whatever form, had chosen to stamp herself upon a character of exceptional nobility.

Presently he spoke aloud. It was a habit he had gained in the last few months of solitude and sorrow. It seemed to relieve him.

"Schopenhauer is right," he said, now. "Life is no more than a task for our accomplishment, a task so hard, so bitter, as to be almost unbearable. Yet I thought differently once, but that was—once. I had her then. I had *her*." And here an indescribable expression of mingled love and anguish crossed his countenance. "Talk to me of fame and accomplishment," he said bitterly, "fame, vapor; accomplishment, despair. I believed in them once. Now let philosophers talk of the glories of accomplishment. Give me human lips and loving hands and warm flesh and blood—heavens! Let me forget! Let me forget! Let me forget!" He arose and walked unsteadily across the room to the window and drew aside the curtain. In its shadow the moon shone on him weirdly. As he looked at it, he muttered to himself. "So it shines on her grave to-night." Just then a gust of wind swept around the corner of the house. He shuddered and moved over to the fire.

"Accomplishment," he said, again. "I have made that word my god. How those lines have rung in my ears all day:

> "Accomplishment my vision crosses,
> Motive alone the powers have made divine;
> The god within the mind life's losses
> Or turns to gall or life's sweet tasting wine

"And what has my accomplishment brought me? Fear! Fear of darkness, fear of sleep, fear of thought, fear, fear of myself. My God! what is accomplishment to a man until he has learned to conquer himself?"

Here the Wizard ceased muttering to himself and gazed moodily into the fire. His words had been intense, but words fail to construe the terrible intensity of passion that had begotten them. They might have come from the mouth of despair herself, so poignant were they in their expression of hopelessness.

And this was the Wizard of Science, this the master, the tamer of the most powerful of the elements, fire. This was he whom the world feared and revered and envied—this was he, the mightiest, compared with whom the veriest beggar on the street was a king. Who shall answer for the vagaries of fortune? Or who blame the constancy of a temperament that, seemingly blest, is yet denied all effort at consolation?

Whatever the shaft that had pierced such a heart, let none judge rashly of so melancholy an acceptance of the decrees of Providence—a flesh-wound to one may be a death-blow to another. This man had lost an adored wife, a woman whose helpful love had done much to make him what he was, spiritually, and had raised him by encouragement and sympathy to the fame and accomplishment he possessed in the world. True, to any of his friends the loss of a wife would have been a slight blow—love little and love often is the motto of the world—and a three months' tide would have seen them at least reconciled to, if not jocular over, the event. But in the world of things there is a female bird that dies with its mate, and the lordly lion owns no second mate. So in the world of men there are hearts that are true. The Wizard of Science was no greater in mind than he was in heart.

With arms resting upon the mantel place, and eyes staring half wildly, half moodily, into the fire, the Wizard spoke again:

"I have heard men who have stood on the brink of an earthquake, and seen men and women and houses swallowed around them, say that they experienced in that moment a sensation of such absolute powerlessness, such impotency, that their brains seemed to recoil on themselves, as a horse is thrown back on its haunches by a powerful shock; that they felt as though they stood absolutely alone on a rock, with the universe tumbling around them, so that their senses reeled. Bah! I stood always on a mental and moral earthquake, with my brain on fire and my belief shaken to its foundations. I no longer even believe in myself. Oh, my God! for some relief! Give me physical pain, tortures. I will bear them without a word. But this horrible sense of voidness! I am nervous to-night—I must not think any more—I must not."

Then the strain changed. "I should like to be in Rome to-night. It is gay there now—in full carnival. We were there three years ago to-night, I remember. It was very gay. If I were there now, perhaps—— But it would not be the same to me now. I forgot. We were there together—together."

At that moment, from the servants' hall below came the faint refrain of an old English glee-song. It was half sad, half merry, and at its close there came a ringing peal of laughter. The master smiled bitterly.

"There is still enjoyment for some in life," he said. But the bitter smile died on his face as a sudden spasm shook his strong frame from head to foot. He trembled like a child in fear, or a leaf in a gale; his countenance changed rapidly from red to white; his eyes looked around him as if seeking help; his hands, as they grasped the marble of the mantel-piece, were white with the intensity of their clutch. His eyes fell on a small shelf on the other side of the room. He tottered over to it, and from a bottle labelled "bromide," with shaking hand, poured a few drops into some water. Then he took down a bottle with "hasheesh" written on it, and poured into the preparation of bromide and water almost a teaspoonful. This dose he swallowed with an avidity that was painful. For fully a minute the terrible struggle of imagination with will continued. Then imagination, recognizing in the hasheesh a master, slowly subsided. It was true the draught had not yet had sufficient time to take effect, but so peculiar a thing is imagination, that the knowledge of having taken the soothing drug produced instantly an effect almost as powerful as that which the drug itself in the course of some minutes must assume.

Slowly and painfully, as though exhausted, the master threw himself into a chair and muttered, "That was a bad attack—the worst for months. For the time I doubted my own identity. Am I never to be free from this terrible dread of insanity that possesses me? Must I always be pursued by this fiend that unceasingly impels me to suicide in spite of myself? If, some day, I should lose my self-control entirely, and should—don't let me think of it—God knows how I suffer—God knows, too, if I deserve it." The Wizard sighed. Gradually a natural color returned to his cheek and his eye lost the intensely wild look that had animated it during the paroxysm. After a moment's pause, he spoke again. "I feel relieved now, a little; but it may come back before the hasheesh can take its full effect. I must work, work, work. To divert the mind, that is the only thing. I mustn't think any more, any more. There! I would work on that *fac-simile* telegraphing machine now if only I had the cylinders. They didn't bring them. Well, well, I must work on something else then—anything so long as I work—it doesn't matter, anything to keep me from thinking. My God! that a man should have to escape thus from his own thoughts."

Slowly and fearfully, as one not sure of his steps, the Wizard walked to the center of the room where stood an already perfected phonograph. Mechanically he brushed and dusted it, and carefully and almost lovingly

he picked up cylinder after cylinder and subjected each to close scrutiny. True, the work with which the Wizard sought to defy time and fear was only the task of a mechanic. But in the work of an inventor there is such an absorbing interest that even the slightest detail becomes a matter of importance and the most trivial task about an invention a work of love.

The age in which the Wizard lived was an age of scientific wonders—an age in moments scarcely beyond our own, but an age in which science ruled supreme — science which, having slept for so many centuries, awakened from her long dream at last, had made strides at which man and time alike marveled. And this age, supreme as the age of science, owned for its master the Wizard. And in past days its achievements had been his glory and his happiness. Now, alas! that time should be so long and its enjoyments so fleeting – now it was only his relief, relief from remembrance and consequent wretchedness. It had been his to make the phonograph the thing of perfection that scientists to-day dream that it may become. It had been his to lend to the kinetograph that last magic touch that had made it the perfect pictorial reproducer of humanity for all times. It was as though into a dull marble a creator had infused life. It had been his too, to give to the reproductions of the microphone eternity as well as correctness. And, although he had performed greater wonders than all these, and had invented instruments of sound and usefulness for the living world far more wonderful, perhaps it was in these that his pride found greatest pleasure. For had not the perfecting of them been the despair of mighty inventors before him? And would not his name roll down on the ages in connection with them, his fame great in comparison with the fame of other inventors as the name of general is great, and justly great, in comparison with that of soldier?

In his den, too, he showed his love for them. There was the perfected microphone with phonographic attachment that caught and held, and repeated when he wished, every word that was uttered in the privacy of his sanctum. Perhaps it was curiosity on his part, perhaps it was experiment, perhaps it was only love that led him to keep a record of everything that was said or occurred there. At any rate, it was so. And stored away on shelves on one side of his room, like a library, were thousands of coils of the phonograph and the kinetograph which, placed in position on their respective machines, would instantly reproduce voices. Some silent now, some still vibrating with warmth and love, but to each one of those coils there was attached a story, that by remembrance appealed to the genius of science. He had taken each of those records himself, and it was at his command that they had been so carefully preserved during the lapse of years. He liked to see them, it reminded him of his work in the past. Sometimes, too, he liked to recall old forms and old voices from the past. In the old days, when he had been buoyant with health and life and happiness, in a jocular mood he had called his den, in reference to the voices and gestures buried there, which, having escaped their owners, had become, in the instant of activity, dead to them in the fact that the same sounds and appearances could never be actually and faithfully reproduced by them; in reference to all these facts, the genius of science had called his den his "Pantheon;" and finally all his old-time friends had fallen into the habit of calling it the Wizard's Pantheon.

But he did not think of these things now, as he worked hurriedly about the phonograph, cleaning it carefully, scraping cylinders for future use, and busying himself generally in a hundred unnecessary ways. In his brain rang constantly the one word "forget." But as the minutes ran on, and the hasheesh commenced to take effect, the word suggested itself to him less frequently. A feeling of hilarity gradually came over him—a feeling of strength even. His brain commenced to work again. His eye caught an expression of enthusiasm. As the influence of the hasheesh penetrated his brain more and more, it whispered to him, "Invent again. Give the world something new. Forget the past. Be once more yourself—the Wizard of Science." Swiftly now its influence overpowered him. He threw down a cylinder suddenly. He had been busy scraping it. For an instant the noise of the crashing cylinder vexed him. In a moment it was over.

Again the hasheesh was whispering to him, "Invent something newer and greater than before, make the world wonder as it has never wondered yet. You alone control the lightning. Let the world know your power."

And then visions grew on the Wizard of wonderful feats in science which even he had not heretofore attempted. As the effects of the hasheesh grew, so grew before him the unexplored realms of science. All at once a new field was opened to him—his brain seemed ready to receive and execute the highest missions of science. With these thoughts at work in his mind, the Wizard touched button after button in his den. In a moment the room was ablaze with a light that was almost unearthly in its brilliancy, a light that could have defied the rays of the monarch of day.

Then the Wizard threw himself back in his chair and yielded himself to the delights of inventing. Slowly and deliciously his thoughts formed themselves into an abstruse mathematical problem. Within 20 minutes, before his mind's eye, the Wizard of Science saw a machine that should defy all the previous discoveries of science. There is no madness more delightful than that of the scientist or the artist. Is it not the delirium of conception? Is not power its instigator, good its aim? No infant dreams of a death's head as it smiles sweetly in its sleep. But this new invention was to be as unlike as it was to be greater than all others. It should give to the pulseless heart new life, it should restore to the unconscious brain new thought, it should possess the power of recalling frail humanity from the clutches of death, it should be the spring of miracles for the world.

How humanity mocks itself! Thoughts are not plans. Until paper has caught the coloring of the most brilliant idea, it is no better than a dream. And until proof follows plan, there is little even in the most cherished invention. With imagination overwrought, and fearing lest with the passing of the moment his mind should lose the birth with which it was pregnant, the Wizard crossed to his desk for pencil and paper. As he did so, his hand jostling the phonograph set in motion the motor, and in a moment his ear was startled by a voice his heart knew only too well. At the sound science, mankind, everything was forgotten—everything but the voice that greeted his ears. The sound that affected him thus was a song of Heine's, instinct with the fire and the sadness of life—the song of the Palm and the Pine. It was one of the old *lieder* his wife had loved so well and in which her rich voice had so often rung, sad and impassioned, over the trembling air, commanding the vibrating chords and giving to sensitive steel and tender wax a melody over which death and time could own no power. Yes, this was her favorite one. Was not the fate of the Palm and the Pine to be their own? And had her keen woman's instinct pierced intuitively that secret of time? All these thoughts swept over the Wizard as those first notes fell on his ear. And then came a reaction. No, she was here with him now. Was not that her voice? His ear knew it—his soul divined the rest. Yes, she had returned to him. When he should turn, in this moment even, he should see her standing there—standing there as of old, waiting for him, and she would nestle again in his embrace and whisper softly in his ear that she loved him, and blush when he kissed her even as she had always blushed at every caress of his—blushed with pleasure and with pride, and—yes—with love. Yes, she was there. The past had been only a horrible dream. Hasheesh whispered all this to him. Hasheesh is no liar while its help is sought. It is only in revenge that it ever mocks the dreamer. Nay, is there in life aught more real than imagination? Is not the madman happy in his dream of power and bliss?

The Wizard turned. Yes, she was there—his wife—as he knew she would be—she was there, her sweet face radiant as of old, her color coming and going, her soul in her eyes, as from her throat issued the sad story of life that Heine alone can tell so well.

Yes, again his eyes rested on her well-beloved form, not dead and motionless now, but instinct with life and grace and feeling. Yes, there before him stood his wife in form and color and motion, as she had been in life. In an instant the Wizard was at her feet. Ah, there is an abandonment in true feeling that simulation can never reach.

As the Wizard knelt before his wife with arms outstretched, a great love and a great fear shone in his eyes. For a moment he was speechless. Then he burst forth in all the force of an impassioned eloquence:

"Sweet, sweet, mine again," he whispered, tenderly; "the world has been cold and bitter since you left my arms. Ah, my heart starves for love, sweet—the good of the world left me with your smile. I have been dead since, dear—dead. I have done no good thing since. I have given the world nothing. I have needed you so, sweet—you. I lived for you before and I did not know it. I thought I lived for science—and I lived only for you. Ah, my sweet, my sweet, what am I without you? Come to me, love—let me fold you in my arms—let me know that you are human—human as well as divine."

And as his voice rang out in passionate appeal, he crept nearer to that beloved thing, nearer and nearer, not dreaming that his own art was mocking him in his delirium. But even as he crept nearer the song did not cease. Still in passionate anguish stood the figure as though nothing but that life-song claimed its soul. But the Wizard moved forward still on his knees, wondering only that his wife, his adored wife, stood before him and would not heed his voice, seemed not even to notice his agony. But no gesture, no glance of hers even escaped his hungry gaze. With the last note of that wail of life, that seemed to come from her very soul, he reached her feet. His arms were outstretched to clasp her in their loving folds. In an instant she would have been his again, his to defy pain and fear and fate. But almost with a sob the song ceased, and as in his arms he attempted to clasp the pictured form of his wife, it faded away into nothing, and his hands met only the cold, hard wall. The Wizard had been mocked by his own tools. Too well for his fevered imagination the kinetograph had done his will. Form and feature and voice and tone had been perfectly registered there—but all were lifeless—true pictures of life, indeed, but nevertheless pictures only.

But scarcely had his imagination, so overwrought by his own fears and by the tyrant hasheesh, found time to recover itself from the shock of her disappearance, when another voice not less familiar, though less loved and less mourned, broke on his ear, another form presented itself to his view. He shuddered and pressed his hands to his head. Yes, the dead had returned to him, indeed, moving and living had they returned to him. He who in the pride of his intellect had scarcely thought of an hereafter now became the victim of his own diseased and overwrought imagination. He believed in the hour of his delirium that a supernatural power had restored to him the dead from the grave. Nay, had he not for proof his sight and his hearing? What more has man ever asked from eternity?

The song was a gay, rollicking baccarole, trolled out in a rich, baritone voice, and as the Wizard listened to it and looked on the frank, laughing face of his lost friend, he forgot himself, in the moment—almost forgot the lost apparition of his wife. His brain was on fire; his limbs seemed to him to have lost the power of volition; beads of perspiration started out on his forehead. So was the Wizard for the moment conquered by his own knowledge and his own avoidance of pain. Not for an instant did the terrible hasheesh permit him to reflect. Had he observed or reflected, indeed, he would have seen instantly that the great self-feeding phonograph and kinetograph, on which 500 coils were placed in rotation, and which required but one single movement to set each in turn in motion, had been started by his own careless hand as he passed in search of pencil and paper. He himself had placed them so the day before, for the purpose of making some experiments, and accidentally it happened that his wife's had come first on the list. That he should not know the coil which held her voice from any other coil was not strange, since on the delicate wax cylinders of the phonograph the traces of the sensitive needle could not be distinguished. A kinetograph attached to the sympathetic diaphragm of the phonograph accounted, with the aid of the hasheesh, for the lifelike figure which had deluded him; for so perfect is the reflected image of a human being in action, color and form on the kinetograph, that one so overwrought and so influenced by the deceiving drug as the Wizard of Science must certainly have been mistaken into the belief that the figure portrayed was human and no effect of a cold and mathematical science.

And as figure and voice in turn died away on phonograph and kinetograph, others followed in their turn. It seemed as if the dead had come back to wish the Wizard a glad New Year. Some were old friends, some sang, some spoke their words of greeting. A great actor, whose art had once charmed the Wizard, and who had in turn been dazzled by the genius of science, came that New Year's Eve and in impassioned tones, and with impassioned action, portrayed for him again the wrongs of Hamlet. From the vagueness, too, a great Faust and a great Marguerite woke the echoes with their passionate, despairing and wonderful portrayal of life. And a mighty emperor, who, partly out of curiosity and partly as a compliment to the genius of science, had spoken into the magic coils words of gratitude and of applause, at its command came forward now and contributed again the words of praise it had long since passed his power to utter.

Throughout the weird pageant, in the midst of compliment and song and warning, the Wizard was silent. He seemed dazed. Voice and figure passed by him and from him as the pageantry of a great festival, barely seen and surely unappreciated, passes by the gaping crowd of would-be seers.

But, listen! Again on the magic instrument is waked a sound that rouses the Wizard from his trance. Again from the faithful kinetograph is reproduced the figure he loved so well. Again, once again, before him, in all the majesty of beauty and power and love, stands one he had so lately deemed lost to him forever. Again before him stands his wife. Ah! What is the endurance of humanity? Great sorrow has less power to harm than great joy. The Wizard's soul leapt into his eyes. He advanced a step with arms outstretched. As he did so, a pallor spread over his face. At that moment it seemed to him as if something tugged at his heart. He paid no heed to it. Was not his love before him?

He made another step forward. A note of sweetness was wafted over the air—his wife outstretched her arms to him. God! What is the lot of mortals? With a supreme joy shining in his eyes, and hope—nay, reality—smiling before him, once more he advanced a step. As he did so, his sight reeled, for a moment he tottered, then he fell—fell like the trunk of a tree severed by a woodman's axe. Straight across the phonograph he fell, arms still outstretched, the joy still shining in his eyes. But the phonograph, the wonderful, brilliant voice of science, was dumb; the delicate needle and the fine workmanship lay shivered on the floor, and the cylinder—the cylinder that had held his beloved's voice—it lay also a voiceless wreck, scattered around him. But the lovely figure stood upright still, with arms still outstretched, and the sad, sweet smile seemed to welcome the genius of science to the realm of fair dreams. For a wonderful smile came over the Wizard's face as he lay there, and when the chimes of the New Year rang out lustily and tenderly and cheerily, to the Wizard they brought only peace—the peace of earthly oblivion. And presently the figure died away on the wall, and the Wizard lay there alone in the first hour of the New Year—alone, with the fair smile still on his face, but with sightless eyes and unthrobbing pulse. Or was it that those staring eyes saw some beautiful object far beyond, that so beautiful a smile should rest on those motionless lips?

But before the morning's sun had risen the faithful Pierre tapped softly on the door of the Wizard's den. He knew that his master could only be driven to rest. Then he opened the door gently, as though fearful of disturbing his master at some mighty task. At first the light of the room dazzled his eyes. When at last he recovered the use of his eyesight, he saw his master lying with cut temples, and with the same smile still on his face, over the ruins of the phonograph; within an hour a famous physician had decided that the master's death was due to incipient heart disease, aggravated by certain stimulating drugs. But the wise crone of a housekeeper pointed again significantly to her head, and her fellow-servants at an autopsy swore it was their firm belief that their master had died for his beloved science from overwork.

It was not until some months later that a famous scientist, who had bought at a sale the perfected microphone of the deceased Wizard, gained from its tell-tale records the true story of the living Pantheon.

A Sub-lunar Luminary.

A Mr. Smith, of San Francisco, has devised a scheme whereby cities can be illuminated by electric lights hanging from balloons. His description of this balloon and its attachments as he has conceived it is as follows:

This balloon will be made of aluminum and in the shape of a cigar, pointed at both ends. It will be about 40 feet long and 15 feet in diameter at its largest point, and will contain sufficient gas to sustain it in the roughest kind of weather. Fans will be constructed so as to hold it point up to the wind and help it from dipping, and in calm weather it will be so balanced that it will remain perfectly level.

A cable containing the electric wires will hold it at a sufficient elevation so that the light will be spread over the area to be illuminated to the best advantage. The balloon will sustain six arc lights, or it can be so made as to be covered with incandescent lights, each one of which will be enclosed with a reflector, so as to concentrate the rays of the light and throw them downward. An appliance will be provided for hauling the balloon to the earth for trimming the light or making any repairs that might become necessary, or raising or lowering it so that the light may be advantageously distributed.

The inventor claims that, counting the first cost of the balloons and their maintenance, the total cost of lighting a city the size of San Francisco will be reduced considerably, as one balloon will suffice for from four to six blocks. At the same time the tangle of deadly and unsightly wires from the streets will be removed and danger from fires reduced. Mr. Smith, in addition to the lights, has invented an arrangement of mirrors, which will be placed on the under side of the balloon, so that a person on one street can see what is transpiring on the next, even though blocks of buildings intervene, and this mirror arrangement, the inventor says, will be of great service to the fire department, as the location of the flames can be easily ascertained should they break out from a building.

We would suggest to Mr. Smith that he should not forget that the intensity of a light decreases as the square of the distance.

CONVENTION ATTENDANTS.

NAMES AND OFFICIAL POSITIONS OF THOSE PRESENT AT THE ST. LOUIS MEETING OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

In the lines which follow appear the names of the different companies represented at the St. Louis Convention of the National Electric Light Association, and also the names of the gentlemen connected with them officially. This is intended to be a complete list, and if any names should happen to be omitted it will result from the fact that they were not registered at the secretary's office in a book provided for that purpose. The REVIEW desires this record to be complete, and if any names are omitted will be pleased to publish an additional list if names are sent to the office.

A

W. H. Ashton, Dayton, O.
T. N. Ambler, St. Louis.
Anniston, Ala., Gas and Light Co., Howard W. Sexton, president, Anniston.
M. P. Ayers, Jacksonville, Ill.
Ansonia Electric Co., Chicago, F. S. Terry, Chas. Wirt, D. E. Goe, M. M. Wood, Chicago.
Alexander, Barney & Chapin, New York, H. G. Issertel, New York.
American Electrical Works, Providence, R. I., P. C. Ackerman, New York.
American Circular Loom Company, Boston, H. H. Brooks, Boston.
Allegheny, Pa., Municipal Plant, D. Hunter, Jr., Allegheny.
Allegheny County Light Company, Robt. G. McGonnigle, Pittsburgh; G. H. Blaxter, Allegheny.
American Electric Light Company, Kansas City, Mo., Leo H. Gamp, Kansas City.
American Electric Manufacturing Company, St. Louis, Louis Nahm, St. Louis.

B

Wm. J. Bailey, Chanute, Kan.
John A. Berkey, St. Paul, Minn.
Boston Incandescent Lamp Company, Boston, Mass., Matt M. Merritt, Boston.
Baker & Company, Newark, N. J., C. O. Baker, Jr., New York.
Brooklyn, N. Y., Police Telegraph Bureau, Frank C. Mason, superintendent, Brooklyn.
Bryant Electric Company, Bridgeport, Conn., W. C. Bryant, Bridgeport; Thos. G. Grier, Chicago.
Ball Electric Light Co., Limited, Toronto, Ont., J. W. Quinlan, Toronto.
Brush Electric Co., Chicago, S. A. Douglas, Chicago.
C. R. Barnes, city electrician, Rochester, N. Y.
W. D. Ball, Chicago.
P. C. Burns, Peru, Ind.
T. S. Boardman, Kenosha, Wis.
R. S. Bishop, Lockport, N. Y.
The E. G. Bernard Co., Troy, N. Y., E. G. Bernard, Troy.
Badger Illuminating Co., Milwaukee, Wis., S. G. Coleman, Milwaukee.
Badger Electric Co., Limited, Racine, Wis., P. H. Korst, Racine.
Bristol, Pa., Electric Light and Power Co., C. A. Bragg, Philadelphia.
Brush Electric Co., Cleveland, O., Fred. A. Scheffler, L. B. Le Vake, Cleveland.
Brush Electric Light Co., Philadelphia, A. J. De Camp, A. H. Manwaring, Philadelphia; H. C. Tudor, Baltimore.

C

Frank S. Culver, Eau Claire, Wis.
Paul D. Cable, Chicago.
Consolidated Electrical Engineering Co., Chicago, W. D. Ball, Chicago.
Chicago and St. Louis Electric Railroad, Dr. Wellington Adams, Prof. F. E. Nipher, Geo. C. Steedman, St. Louis; E. F. Seixas, Chicago.
Card Electric Dynamo and Motor Co., Cincinnati, J. W. Wilshire, general manager, Cincinnati.
Consolidated Electric Manufacturing Co., Boston, C. E. Bibber, general manager, Boston.
Campbell Electric Supply Co., Boston, Geo. F. Talcott, Boston.
Cotton and Woolen Insurance Co., Boston, Capt. Wm. Brophy, Benjamin Taft, Boston.
Cincinnati Electric Light Co., Chas. J. Faust, Cincinnati.
Cincinnati Edison Electric Co., John Turner, Cincinnati.
T. E. Crossman, Brooklyn, N. Y.
Chapman Valve Manufacturing Co., Boston, E. W. Buss, western manager, Chicago.
J. O. Crane, Waterbury, Conn.
Camden Lighting and Heating Co., Camden, N. J., Hon. E. A. Armstrong, John J. Burleigh, Camden.
M. J. Cowgill, Omaha, Neb.
Citizens' Electric Illuminating Co., Brooklyn, N. Y., E. F. Peck, superintendent, Brooklyn.
W. B. Cleveland, Cleveland, O.
Commercial Electric Co., Indianapolis, Ind., A. D. Adams, Indianapolis.
Chicago Arc Light and Power Co., C. H. Wilmerding, general manager, Chicago.
F. A. Churchill, Jr., St. Louis.
Canadian Electric Construction and Supply Co., Montreal, Que., Albert J. Corriveau, Montreal.
Consumers' Electric Light and Power Co., De Soto, Mo., J. D. Barth.
J. M. Clower Supply Co., Dallas, Tex., D. M. Clower.
George Cutter, Chicago, George Cutter, H. I. Hadaway, Chicago.
Carpenter Enamel Rheostat Co., Bridgeport, Conn., C. E. Carpenter, Bridgeport; C. D. Shain, New York.
H. C. Craig, Stevens Point, Wis.
Complete Electric Construction Co., New York, John A. Seely, New York.
The Cutter Electrical and Manufacturing Co., Philadelphia, Henry B. Cutter, Philadelphia.
The "C. & C." Electric Motor Co., New York, A. Mitchell Hall, New York; C. E. Wilson, Chicago.
Central Electric Co., Chicago, W. H. McKinlock, C. E. Brown, Chicago.

D

Davenport, Ia., Power and Light Co., Charles W. Grant, Davenport.
A. W. Dutton, St. Louis.
J. R. Dee, Houghton, Mich.
Des Moines, Ia., Edison Light Co., J. A. Colby, Des Moines.
Doubleday, Mitchell & Co., New York, P. W. Mitchell, New York.
Denver, Colo., Consolidated Electric Co., E. W. Rollins, R. H. Sterling, Denver.
T. M. Doan, Jacksonville, Ill.
I. T. Dyer, St. Joseph, Mo.
Diamond Incandescent Lamp Co., Denver, Col., S. S. Campbell, Denver.
D. L. Davis, Salem, O.

E

Englewood Electric Light Co., Chicago, Charles T. Page, Chicago.
Electric Engineering and Supply Co., Syracuse, N. Y., H. J. Gorke, general manager, Syracuse.
East River Electric Light Co., New York, John J. Moore, New York.
Electric Selector and Signal Co., New York, C. P. MacKie, Herbert Laws Webb.
Edison Illuminating Co., New York, H. J. Smith, New York.
Electric Construction and Supply Co., New York, R. B. Corey, general manager, New York; E. A. Cummings, Chicago.
H. Elliott, Jr., St. Louis.
Eddy Electric Manufacturing Co., Windsor, Conn., A. D. Newton, M. E. Baird, Windsor; G. A. S. Kohler, F. W. Kohler, Chicago.
Edison Electric Illuminating Co., New Brunswick, N. J., A. J. Jones, New Brunswick.
Enterprise Electric Co., Chicago, Walter C. McKinlock, Chicago; W. H. Ferris, St. Louis.
Eureka Tempered Copper Co., North East, Pa., John R. Coffman, Detroit.
Electric Appliance Co., Chicago, Thos. I. Stacey, A. L. Millard, Chicago.

F

Falls Rivet and Machine Co., Cuyahoga Falls, O., E. L. Babcock, C. A. Babcock, Cuyahoga Falls.
Fidelity Carbon Manufacturing Co., St. Louis, S. G. Booker, general manager, St. Louis.
Fort Wayne Electric Co., Fort Wayne, Ind., Chas. S. Bradley, Jas. J. Wood, C. S. Knight, Fort Wayne; F. A. Wunder, Chicago; W. J. Morrison, New York; E. T. Pardee, Syracuse, N. Y.
Falconer Manufacturing Co., Boston, A. G. Sargent, Boston.
J. A. Ferguson, St. Louis.
W. L. Fowler, St. Louis.
Franklin Electric Co., Kansas City, Mo., G. E. Claflin, Kansas City.
W. A. Foote, Jackson, Mich.
Forest City Electric Light and Power Co., Rockford, Ill., M. A. Beal, W. E. Hinchcliff, Rockford.
Prof. George Forbes, London, Eng.
J. B. Foote, Battle Creek, Mich.

G

Gladstone, Mich., Electric Light and Power Co., Edwin S. Tice, Gladstone.
Globe Carbon Co., Ravenna, O., C. L. Rodman, Ravenna.
J. F. Gerleman, St. Louis.
General Incandescent Arc Light Co., New York, Augustus Noll, New York.
The E. S. Greeley & Co., New York, F. A. Magee, New York.
Garton-Daniels Electric Co., Keokuk, Ia., M. Garton, Keokuk.
General Electric Co., New York, B. E. Sunny, J. Scribner, Chicago; Dr. Louis Bell, C. S. Haley, Boston; P. A. Clisdell, T. J. Ryan, Geo. B. Edgar, J. L. Meloon, R. S. Stearnes, Cincinnati; John J. Moore, New York; Wilson S. Howell, Harrison, N. J.
C. E. Gregory, Chicago.
E. B. Greene, Altoona, Pa.
W. J. Greene, Cedar Rapids, Ia.

H

Helios Electric Co., Philadelphia, D. C. Spruance, Philadelphia.
W. J. Hammer, New York.
Heisler Electric Co., Philadelphia, W. S. Horry, Philadelphia.
J. H. Hopkins, St. Louis.
Hart & Hegeman Manufacturing Co., Hartford, Conn., Geo. S. Searing, Chicago.
Vivian Hawkes, London, Eng.
H. H. Harding, Carthage, Mo.

I

Indiana Rubber and Insulated Wire Co., Chicago, C. J. Butler, Chicago.
International Okonite Co., Limited, New York, George T. Manson, general superintendent, New York; W. H. McKinlock, C. E. Brown, Chicago.
Interior Conduit and Insulation Co., New York, E. W. Little, general manager, Romaine Mace, New York.

J

Jewell Belting Co., Hartford, Conn., C. E. Newton, Hartford.
Janesville, Wis., Electric Light Co., Pliny Norcross, Janesville.
Jenney Electric Motor Co., Indianapolis, Ind., C. D. Jenney, Indianapolis.
C. E. Jones, Cincinnati.
H. W. Johns Manufacturing Co., New York, E. B. Hatch, Hartford.

K

Keystone Light and Power Co., Philadelphia, T. Carpenter Smith, Philadelphia.
Kerite Wire Co., New York, E. B. McClees, New York; S. F. B. Morse, Chicago.
Knox College, Galesburg, Ill., Edgar L. Larkin, Galesburg.
Kirksville, Mo., Electric Co., J. B. Bragg, Kirksville.
Kester Arc Lamp and Manufacturing Co., Ironwood, Mich., J. F. Kester, Chicago.
J. C. Knight, New York.
W. C. Knight, Fort Wayne, Ind.
James M. Kearney, Chicago.

L

The F. P. Little Electrical Construction and Supply Co., Buffalo, N. Y., F. P. Little, Buffalo.
Laclede Gas Light Co., St. Louis, F. Schlosser, St. Louis.
Law Battery Co., New York, M. M. Hayden, New York.
The Lintner Electric Co., Minneapolis, Edwin L. Tice, Minneapolis.
Louisiana Electric Light Co., New Orleans, La., Wm. Oswald, New Orleans.
Lancaster Carbon Co., Buffalo, N. Y., R. J. Getz, Wm. C. Hodge, Buffalo.
H. M. Loud & Sons Lumber Co., Au Sable, Mich., G. H. Keating, Bay City, Mich.
E. E. Little, Pittsburgh.
M. L. Lipscomb, Columbia, Mo.

M

Jas. J. Murray & Co., Philadelphia, J. K. Martin, Philadelphia.
Massachusetts Chemical Co., Boston, Harry Bishop, Chicago.
Metropolitan Electric Railway Co., Springfield, Mo., Frank B. Smith, Springfield.
Robb MacKie, city electrician, Cincinnati, O.
Memphis, Tenn., Light and Power Co., W. W. Carnes, F. E. Boardman, Memphis.
Manufacturers Advertising Agency, New York, B. R. Western, New York.
Munson Belting Co., Chicago, J. H. Shay, Chicago.
Municipal Electric Lighting and Power Co., St. Louis, James I. Ayer, general manager, St. Louis.
Municipal Electric Light Co., Brooklyn, N. Y., James Ferguson, superintendent, Brooklyn.
C. McIntire, Newark, N. J.
Metropolitan Electric Corporation, Kansas City, Mo., Thos. F. Clohesy, Kansas City.
W. N. Matthews, St. Louis.
A. L. McRae, Rolla, Mo.
Mosher Electric Co., Chicago, G. L. Reiman, president, J. A. Mosher, vice-president, Chicago.
C. H. McFall, New Orleans, La.
John J. Moore, Toledo, O.
Mather Electric Co., Boston, Chas. I. Hills, Boston.
Missouri Water and Light Co., Kansas City, Mo., Geo. M. Meyers, Kansas City.
H. H. McDuffie, Pittsburgh.
F. Moore, Pittsburgh.
G. E. McFarland, Davenport, Iowa.
H. S. Manning, Chicago.
Frank McMaster, Chicago.
H. C. Myers, New York.
A. M. Miller, Kansas City, Mo.
Geo. Mayo, Rockford, Ill.
C. K. Mead, Des Moines, Ia.
W. E. McCullough, Beardstown, Ills.

N

New York and Ohio Co., Warren O., W. D. Packard, Warren, O.
Norwich Insulated Wire Co., New York, George J. Jackson, New York.
Nelsonville, O., Electric Light Co., M. Poston, Nelsonville.
New York Insulated Wire Co., New York, J. W. Godfrey, New York.
National Electric Headlight Co., Indianapolis, Ind., George C. Pyle, Indianapolis.
New Britain, Conn., Electric Light Co., L. C. Whitney, New Britain.
National Electric Light Association, James I. Ayer, St. Louis; E. A. Armstrong, Camden, N. J.; C. H. Wilmerding, Chicago; George F. Porter, John A. Seely, C. O. Baker, Jr., New York; Robb MacKie, Cincinnati; E. F. Peck, Brooklyn; M. J. Francisco, Rutland, Vt.; Frederic Nichols, Toronto; H. H. Fairbanks, Worcester, Mass.

O

W. T. Osborn, Kansas City, Mo.

P

Phillips Insulated Wire Co., H. C. Adams, president, New York.
Pierce & Miller Engineering Co., New York, J. D. Miller, New York.
Partrick & Carter Co., Philadelphia, E. Ward Wilkins, Philadelphia.
H. T. Paiste, Philadelphia.
Pennsylvania Railroad, H. M. Haines, New York; W. H. Markland, Altoona, Pa.
Peru, Ind., Electric Manufacturing Co., J. H. Orr, Peru.
Peutz-Reckenzaun Electric Co., Philadelphia, James A. Pentz, Philadelphia.
J. H. Parker, St. Joseph, Mo.
F. J. Pearson, Omaha.
Pullman Palace Car Co., A. H. Bauer, electrician, New York.

R

Roodhouse, Ill., Electric Light Co., C. H. Higbee, Jr., Roodhouse.
Rensselaer, Ind., Water, Light and Power Co., Wm. B. Austin.
Rockford, Ill., Electric Mfg. Co., W. B. Roberts, Rockford.
Rankin Electric Co., Tarkio, Mo., W. F. Rankin, Tarkio.
Royce & Marean, Washington, D. C., F. W. Royce, Washington.
Rutland, Vt., Electric Light Co., M. J. Francisco, Rutland.
Rochester, N. Y., Gas and Electric Light Co., Geo. A. Redman, Rochester.
Rockaway Electric Light Co., John A. Seely, New York.
John A. Roebling's Sons Co., New York, Geo. C. Bailey, A. B. Conover, Jr., Chicago.
Rose Electric Light Supply Co., St. Louis, P. H. Rose, St. Louis.
C. A. Ross, Kansas City, Mo.
A. H. Reece, Denver, Col.
R. J. Randolph, Cincinnati.

S

Springfield, O., Light and Power Co., J. H. Miller, Springfield.
Standard Oil Co., Cleveland, O., F. A. Lane, Cleveland.
Shultz Belting Co., St. Louis, J. A. J. Shultz, B. C. Alvord, St. Louis; A. B. Laurence, New York.
Simplex Electrical Co., Boston, J. H. Mason, Boston.
St. Louis Electric Light and Power Co., A. Partridge, R. V. Scudder.
Siemens & Halske Electric Co. of America, Chicago, C. D. Shain, New York.
Standard Underground Cable Co., Pittsburgh, J. W. Marsh, Pittsburgh; Fred. Degenhardt, Chicago; J. P. McQuaide, New York.
Stanley Electric Manufacturing Co., Pittsfield, Mass., Chas. Atwater, president; Henry Hine, general manager, Albert Taylor, Pittsfield.
Chas. A. Schieren & Co., New York, E. P. Atkinson, New York; A. W. Harvey, Chicago.
Sewickley, Pa., Electric Co., E. P. Young, Sewickley.
Standard Paint Co., New York, P. H. Hoover, New York.
Steubenville, O., Gas and Electric Co., J. Gwynn, Thomas Johnson, Steubenville.
St. Joe and Benton Harbor, Mich., Electric Light and Railway Co., W. Worth Bean, St. Joseph, Mich.
Standard Electric Co., Chicago, F. E. Drake, E. P. Perry, Chicago.
San Miguel Construction Co., Telluride, Col., P. N. Nunn, Telluride.
Southern Engineering Co., Louisville, Ky., Campbell Scott, Louisville.
H. B. Slater, Canyon City, Col.
Wm. Shrader, Columbia, Mo.
T. Perry Smith, Fayette, Mo.
A. M. Searles, Chicago.
H. H. Small, Chicago.
C. W. Stewart, Chicago.

T

Taylor, Goodhue & Ames, Chicago, Wells Goodhue, Chicago.
A. C. Thompson, St. Louis.

Thomson-Houston Carbon Co., Fremont, O., D. F. Urquhart, Boston.
A. A. Tibbe, Washington, Mo.
C. H. Talmage, St. Louis.
Taylorville, Illinois, Electric Co., J. N. C. Shumway, manager, Taylorville.
Robert B. Tabor, Boston.
Nikola Tesla, New York.
T. E. Thebauth, Chicago.

U

Union Electric Co., Seattle, Wash., Dr. E. C. Kilbourne, Seattle.

V

The Vandalia, Ill., Light and Fuel Co., D. M. Clark, Annie M. Clark, assistant manager, Vandalia.
Vincennes, Ind., Electric Light and Power Co., H. W. Frund, Vincennes.
The Valentine-Clark Co., Chicago, John Valentine, Ernest L. Clark, Chicago.

W

Fremont Wilson, New York.
A. P. Warren, Fayette, Mo.
C. P. White, Evansville, Ind.
Robert E. Wyant, Birmingham, Conn.
R. S. Willard, Cuyahoga Falls, O.
Westinghouse Electric and Manufacturing Co., Pittsburgh, C. A. Bragg, Philadelphia; Alex. Jay Wurts, E. H. Heinrich, L. B. Stilwell, Pittsburgh; E. W. Seymour, New York; Calvert Townley, Pittsburgh.
Washington Carbon Co., Pittsburgh, Pa., J. S. Crider, Pittsburgh.
Weston Electrical Instrument Co., Newark, N. J., Prof. Edward Weston, R. O. Heinrich, Newark; C. D. Shain, New York.
Washington Electric Light, Heat and Power Co., Washington Court House, O., Jerome Penn, Washington C. H.
Webb City Light and Power Co., George M. Meyers, Kansas City, Mo.
Washburn & Moen Manufacturing Co., Worcester, Mass., Edward Stockwell, Chicago.
Wilson & Jackson, Chicago, Chas. H. Wilson, Chicago.
C. G. Woods, St. Louis.
West End Electric Co., Philadelphia, A. J. Martin, Philadelphia.
West Superior Wis., Water, Light and Power Co., A. A. Cross, West Superior.
S. E. Whitehead, Carthage, Mo.
Worcester, Mass., Electric Light Co., H. H. Fairbanks, Worcester.
Western Electric Co., Chicago, Geo. L. Beetle, E. W. Goldsmith, Chicago.
Prof. Edward Weston, Newark, N. J.
E. E. Wade, Colorado Springs, Colo.

Z

F. C. Zimmerman, Carterville, Ill.

LADIES IN ATTENDANCE.

Miss Elizabeth W. Armstrong, Camden, N. J.
Mrs. W. B. Austin, Rensselaer, Ind.
Mrs. J. J. Burleigh, Camden, N. J.
Miss Retta Burleigh, Camden, N. J.
Mrs. Louis Cassier, New York.
Mrs. D. M. Clark, Vandalia, Ills.
Miss Cumming, Philadelphia.
Mrs. A. J. De Camp, Philadelphia,
Miss De Camp, Philadelphia.
Miss Annie E. Fortiner, Chicago.
Mrs. M. J. Francisco, Rutland, Vt.
Mrs. C. W. Grant, Davenport, Ia.
Mrs. Mosbier T. Greene, Chicago.
Mrs. A. H. Manwaring, Philadelphia.
Mrs. Geo. T. Manson, New York.
Mrs. C. K. Mead, Des Moines, Ia.
Miss Carrie W. Morgan, Camden, N. J.
Mrs. Geo. M. Myers, Kansas City, Mo.
Mrs. W. H. McKinlock, Chicago.
Mrs. Pliny Norcross, Janesville, Wis.
Mrs. D. H. Ogden, Chicago.
Mrs. J. N. Quine, Rochester, N. Y.
Mrs. Geo. A. Redman, Rochester, N. Y.
Mrs. R. S. Willard, Cuyahoga, Falls, O.
Mrs. F. A. Wunder, Chicago.

TECHNICAL JOURNALS REPRESENTED.

ELECTRICAL REVIEW, New York, Chas. W. Price, H. T. Richards, New York; M. J. Bulkley, Chicago.
Street Railway Journal, New York, C. E. Stump, New York; J. W. Dickerson, Chicago.
World's Fair Electrical Engineering, Chicago, Fred. DeLand, Chicago.
Power, New York, H. M. Swetland, New York
Electrical Age, New York, J. B. Taltavall, W. T. Hunt, New York.
Electrical Industries, Chicago, E. L. Powers, Chicago; E. E. Wood, New York.
Electricity, New York, B. E. Greene, New York; W. S. Key, Boston; J. F. Conner, Chicago.
The Electrical Engineer, New York, T. C. Martin, F. R. Colvin, New York; L. W. Collins, Chicago.
Cassier's Magazine, New York, Louis Cassier.
Electrical World, New York, W. J. Johnston, Nelson W. Perry, New York; D. H. Ogden, Chicago.
Western Electrician, Chicago, W. F. Collins, J. B. O'Hara, F. L. Perry, Chicago; W. F. Osborne, New York.
Street Railway Gazette, Chicago, M. J. Sullivan, Chicago.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

FITCHBURG, MASS.—A bill before the legislature authorizes the Fitchburg and Leominster Street Railway Company to extend its tracks and increase its capital to $500,000.

MEADVILLE, PA.—The Meadville Street Railway Company; capital, $30,000. Incorporators, Geo. D. Trawin, H. H. Thompson, Charles Fahr and F. R. Shyrock. The line will run through the streets of Meadville.

FARGO, N. DAK.—The city council has granted a franchise to a new electric light company, which promises to reduce the present rates about 30 per cent. and also to build an electric line between Fargo and Moorhead.

POTTSVILLE, PA.—The Citizens' Electric Railway Company; capital, $200,000. Directors, N. H. Koch, L. R. Keefer, J. H. Zerbey, P. K. Filbert and C. K. Acker. The line will be ten miles long and run from Pottsville to Minersville, Primrose, Jonestown and Forestville.

MIDDLETOWN, PA.—The directors of the Middletown Electric Railway Company have elected John W. Rife, president; Walter H. Kendig, vice-president; George H. Grove, secretary; and Edward M. Hoffer, treasurer.

BROCKTON, MASS.—Brockton and Boston capitalists have planned a system of electric railways which will connect several towns in the northern part of Plymouth county with Brockton. The Brockton and Bridgewater Street Railway Company; capital, $200,000; the Brockton and Stonington Street Railway Company; capital, $150,000; the Brockton and East Bridgewater Street Railway Company; capital, $100,000; and the East Bridgewater and Bridgewater Street Railway Company, have already been organized by Hosea King, J. C. Leach, of Bridgewater; John R. Morse and H. B. Rogers, of Brockton; George H. Campbell, of Boston; and others.

ROCKLAND, ME.—The Rockland, Thomaston and Camden Street Railway Company will enlarge its power house and put in a 600 horse-power Corliss engine.

NEW BRUNSWICK, N. J.—It is reported that a syndicate is making efforts to obtain control of the present city railway, with the view of introducing electricity.

DALLAS, TEX.—The Queen City Railway Company has been incorporated, with a capital of $40,000. The directors are Seth Miller, J. S. Armstrong, A. W. Childress, of Dallas; B. E. Sunny and C. L. Wakefield, of Chicago.

CLARKSVILLE, TENN.—The agent of the St. Louis Electric Railway Car Company has submitted a proposition to the Clarksville Street Railway Company, to place electric lines in operation at a cost of about $25,000.

COATESVILLE, PA.—The Lancaster and Philadelphia Electric Railway Company has secured right of way over the greater portion of its proposed route, and after April 1 contracts will be entered into with the Westinghouse Company for equipment.

HOBOKEN, N. J.—The North Hudson County Railroad Company has decided to dispense with the cable and use the trolley system entirely.

CLEVELAND, OHIO.—W. C., C. W. and G. F. Scofield will build an electric street car line to Gordon Park, and application for a franchise has been made to the city council.

DENVER, COLO.—The City Park Railway Company has petitioned the county commissioners for right of way, with the privilege to construct a line of street railway to be operated by cable or electric power.

PHILADELPHIA, PA.—The Powelton Avenue and Thirty-fourth Street Passenger Railway Company has been incorporated, with a capital of $20,000, by G. A. Aldrich, of Audubon, N. J.; C. J. Young, John F. Keator, and H. E. Aldrich, of Philadelphia.

MONONGAHELA CITY, PA.—The Monongahela City Street Railway Company; capital, $15,000. Incorporators, Charles Hinds, W. K. Law and Daniel A. Cameron, of Pittsburgh. The company will build a line two and a-half miles long.

JERSEY CITY, N. J.—The syndicate of New York and Philadelphia capitalists, headed by John D. Crimmins, which, on February 10, bought all the horse and electric railways in Essex county, has decided to increase its capital to $8,000,000. This was done after engineers had looked over the ground and decided that the construction of the power houses and machinery would cost a great deal more than had been expected.

WELLSBURG, W. VA.—A number of citizens have formed a company and made application for a charter to build an electric motor line from Lazearville to Wellsburg and Bethany. The incorporators of the line are Samuel George, ex-Sheriff Curtis and Mayor McCleary.

PHŒNIXVILLE, PA.—The Phœnixville Electric Street Railway Company; capital, $50,000. Incorporators, Charles P. Perot, Wm. C. Hannis and L. K. Perot of Philadelphia; Richard W. David, of Lower Merion.

CAMDEN, N. J.—The Camden and Princeton Connecting Company; capital, $100,000. Incorporators, J. Randolph Appleby, of Jersey City; Charles T. Blondin and James Benson, of New York. The object of the company is the connection of the two cities by an electric or pneumatic railroad.

GETTYSBURG, PA.—The Inter-State Traction Company; capital, $70,000. Incorporators, James B. Reilly, Irwin T. Reiter, Howard L. Calder and Alexander Simes, of Philadelphia.

CARTHAGE, N. Y.—Capt. George Sweet is forming a company for the purpose of building a street railroad from Richfield Springs to Lake Canadarago. The capital is $10,000, most of which has been taken.

ALLENTOWN, PA.—A new company, backed by A. L. Johnson, of Cleveland; John K. Page and Howard Page, of New York, will build an electric railway from Egypt to Allentown and South Bethlehem. The company is to be known as the Lehigh Valley Traction Company.

CENTRALIA, ILL.—A stock company has been organized to build and operate an electric light and street railway from Centralia to Central City, Sandoval and Odin. S. N. Pierce, O. V. Parkinson and B. Haussler, of Centralia, are interested.

MIDDLETOWN, N. Y.—The Middletown Street Railroad and Power Company, to build and operate a street surface railroad through the streets of Middletown; length, five miles; capital, $50,000. Directors, C. MacCordell, W. F. O'Neill, W. D. Stratton, A. V. Book, L. Brink, E. A. Brown, F. D. Youngblood, T. A. Weller and M. D. Stivers, Middletown.

HARRISBURG, PA.—The Philadelphia and Allentown Electric Trunk Railway Company has secured a charter; capital, $1,000,000. The line will extend from Allentown to Philadelphia, and touch all the principal points between the two cities, including South Bethlehem, Cooperstown and other places. W. R. Grace, of New York city, is the president.

BOSTON, MASS.—The Suburban Traction Company, with a capital of $3,000,000, has been organized by Boston capitalists, to operate street railways electrically in Orange, N. J., and its vicinity.

Electric Light and Power.

PEORIA, ILL.—The Hancock County Electric Light and Power Company, capital, $15,000, and the Farmington Electric Light and Power Company, capital, $12,000, have been incorporated. The incorporators for both companies are E. B. Hillman, L. T. Bradley and H. T. Hay.

DOYLESTOWN, PA.—The Doylestown Electric Company has voted to increase the capital of the company to $25,000. The company has added new machinery to its plant.

DEPERE, WIS.—The city council has granted a franchise to John P. Dousman and others to furnish the city electric lighting for a period of 10 years.

CHARLOTTE, N. C.—It is proposed to erect a large electric plant at the Catawba river, and run wires from there to Charlotte.

MARSHALL, MO.—The Marshall Electric Light and Power Company; capital, $30,000. Incorporators, Thomas Wardell, William E. McCully and H. M. Rubey.

SEATTLE, WASH.—Snoqualmie Falls, 22 miles east of this city, are to be connected with this city by underground cables and made to supply all the electric power required here for the next 25 years. The intention is to place a number of turbine wheels at the foot of the falls and transmit power to shafting, which will be conveyed to immense electric machinery on the banks. W. T. Lacy, of San Francisco, and Guy C. Penney, of Seattle, are the promoters of the enterprise.

HAGERSTOWN, MD.—Wyatt M. Keedy, city clerk, writes that he has been ordered to advertise for bids for electric street lighting. The present contract expires July 1.

ELECTRIC LIGHT FLASHES.

The Milton Electric Light Company, Milton, Pa., are putting in a 100 horse-power Ball engine, furnished by J. W. Parker & Company, Philadelphia representatives of the Ball Engine Company, Erie, Pa.

It is declared that Henry M. Whitney, president of the West End Street Railroad, of Salem, Mass., denies officially that the corporation intends selling out its control to the Lynn and Boston Road. An equally high official on the Lynn and Boston Road, however, claims the reports are true, and the entire deal will be made public within a short time.

The Vincennes Electric Light and Power Company, Vincennes, Ind., recently held its annual meeting and re-elected the present directors and H. W. Frund general manager. Officers reports show 100 per cent. increase in business and $20,000 new machinery installed during the past six months. This company has one of the cleanest and finest equipped plants in the State.

KINDRED INTERESTS

The Stonington Line continues to be very popular with travelers between New York, Providence and Boston.

The Central Electric Company have just placed upon the market a hard rubber hydrometer, which is pronounced to be vastly superior to the old glass form hydrometer. This company will send free to applicants each month the bulletin relating to architects published by the Interior Conduit Company, of New York.

The Berlin Iron Bridge Company, of East Berlin, Conn., have secured the contract for the new buildings required by Wm. Cramp & Sons' Ship and Engine Building Company, Philadelphia, Pa. The Berlin Bridge Company have lately completed a boiler shop for the Cramps, and now have a contract for all the other buildings required to enlarge their plant. The new buildings will consist of a ship shed, 60 feet by 100 feet, a blackboard 75 feet by 200 feet, and a bending shed 86 feet by 150 feet, constructed throughout of iron.

The Mica Insulator Company filed articles of incorporation March 1, 1893, at Elizabeth, N. J., the authorized capital being placed at $100,000; all paid in. The company's plant is located at Schenectady, N. Y., while its office and salesroom will be at 218 Water street, New York city. The officers are Eugene Munsell, president, Franklin Brooks, vice-president, and Lewis W. Kingsley, secretary and treasurer. The company will manufacture Micanite for electrical insulation, a description of which has appeared in our columns. Through a process controlled by this interest, small scrap mica is now utilized in all forms and shapes for insulating purposes where sheet mica was formerly used, at a much reduced cost, and with no diminution in efficiency.

The Joseph Dixon Crucible Company, Jersey City, N. J., through its vice-president, Mr. John A. Walker, informs us that the company "has at last been awarded space in the Columbian Exposition—a space 25x28 feet in the Mines Building—for a general exhibit of graphite productions, such as crucibles, lubricating graphite, graphite axle grease, plumbago facings, graphite machine and railway grease, Dixon's stove polish, silica-graphite paint, core wash, electrotyping graphite, graphite cylinder oil, graphite specialties for electrical and other work, etc. A space of 13x10 feet only was obtainable in the Manufactures Building for an exhibit of Dixon's 'American Graphite' pencils and pencil sundries. Although the assignment of space has been tardy, and the amount of space much less than required, and not much time left to properly equip it, yet we propose to be there on time and in as good shape as possible. We shall also be very glad, then and there, to see the million and one friends of the Dixon Company and 'American Graphite' pencils."

The MacKaye Spectatorium.

It is said that one of the most remarkable and novel features to be seen at Chicago during the World's Fair in the way of fine art, so far as a dramatic and lyric presentment is concerned, will be the production promised in "the MacKaye Spectatorium," an immense building of rare architectural beauty and originality of design, which is now being rushed to completion at the north end of Jackson Park, on the lake shore. The building itself, the nature of the production and every accessory is the creation of that well known author and inventor, Mr. Steele MacKaye. The carrying out of this conception is backed by the leading merchants, business men, trade barons, social kings and financiers of Chicago; men whose names are synonomous with success. In the list of subscribers are found such names as George M. Pullman, Murry Nelson, Lyman J. Gage, Benjamin Butterworth, E. B. Butler, J. O. Hinkley, E. W. Gillett, P. E. Studebaker, Gen. A. C. McClurg, C. L. Hutchinson and others of like potency. "The MacKaye Spectatorium" will be completed in ample time for the opening of the Fair. The cost of the building and production will be about $1,500,000, and the building is 500x380 feet, ground area.

ST. LOUIS CONVENTION NOTES.

A few notes of more or less interest relating to the Convention, both in its meetings and outside, appear below:

There were 110 central stations represented at the Convention, a very good showing, all things considered.

Charles I. Hills, of the Mather Electric Co., presented unique silver plated screw drivers to his friends.

Mr. W. C. McKinlock, of the Enterprise Electric Company, Chicago, brought with him the usual quantity of sunshine that goes with his jovial nature. There is a winning personality as well as energy about Mr. McKinlock that should bring him full success with his comparatively new company.

Mr. P. C. Ackerman, the New York representative of the American Electrical Works, had the pleasure and satisfaction of closing up a big wire order while attending the Convention. Mr. Ackerman is the alert representative of one of the most popular and successful insulated wire and cable companies in the United States. There was only needed the presence of President Eugene F. Phillips, of the American Electrical Works, to make the occasion entirely complete.

Col. H. C. Adams, of New York, the president of the Phillips Insulated Wire Company, of Pawtucket, R. I., was one of the two or three present at St. Louis who were present on the occasion of the first meeting of the National Electric Light Association in Chicago, in February, 1885. The wire company represented by Colonel Adams has won an excellent reputation for its product and will, though a comparatively new company, soon take high rank in its field.

Electrical People at the World's Fair.

A number of electrical people returning from the St. Louis Convention stopped in Chicago and visited the World's Fair. All were impressed with the magnitude and beauty of the buildings.

Dr. J. E. Hornsby, secretary of the Department of Electricity, extended a warm welcome to the electrical visitors and personally conducted the party through the grounds, visiting the immense power and lighting plant. The doctor extended the courtesy of a delightful luncheon to Prof. Edward Weston, Mr. E. F. Peck, Mr. Herbert Laws Webb, Mr. C. E. Stump, Mr. F. C. Mason and others.

The exhibits of the American Bell Telephone Company and the Western Electric Company are being rapidly put in place, and it is expected that within the next 10 days other electrical exhibits will be forwarded. The electrical press has been allotted a gallery and will all be found in one consecutive, harmonious and intellectual group.

GENERAL NOTES.

It is expected that Doylestown, Pa., will soon have a trolley line to Perkasie.

A movement is on foot to build an electric car line into Rincon, four miles from Santa Rosa, Cal.

The Dartmouth and Westport, Mass., Street Railway Company and the Fall River and New Bedford Railway Company are rivals for securing locations in Dartmouth and Westport for the purpose of building electrically equipped roads from New Bedford to Fall River.

PARTY representing ample Capital for the purpose wishes to correspond with Inventor or Owner of a really good Motor Type Incandescent Meter, with a view to manufacturing the same. State full particulars and, if article is patented, give number of patent. Address,

MOTO-METER,

ELECTRICAL REVIEW OFFICE, NEW YORK.

ELECTRICAL MEASUREMENT

Instruments and Batteries of the Very Highest Grade.

Precision and Constancy, Quality and Finish the Best in the World.

Catalogue of Standard Test Instruments furnished upon application.

THE E. S. GREELEY & CO.,

5 AND 7 DEY ST., NEW YORK.

RAILS

We own and offer for sale, cheap, 400 tons of second-hand 59 lb. STEEL RAILS, at Pittsburgh, Pa., in excellent condition to relay. We sell

NEW STEEL RAILS

at lowest prices. Write or wire us:

ROBINSON & ORR,

419 Wood St., PITTSBURGH, PA.

ENGINE CASTINGS

from one-eighth to six horse power Horizontal & Marine.

8, 16 & 60 LIGHT DYNAMO CASTINGS.

Simple Sewing Machine and Fan Motor Castings with instructions for building complete machines.

Send Stamp for Catalogue.

PALMER BROS., Electrical Supplies, Mianus, Conn.

ALUMINUM!

THE COWLES ELECTRIC SMELTING & ALUMINUM COMPANY,

Lockport, - New York,

Offer Pure Aluminum in Ingots, Slabs, Sheet, Wire and Castings at lowest market rates.

Aluminum Bronze, Aluminum Brass, Silver Bronze, Silicon Bronze and Manganese Bronze.

SPECIAL,

CANDELABRA

AND MINIATURE

INCANDESCENT LAMPS.

For information and prices covering Special Candelabra and Miniature Incandescent Lamps, address the

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT,

HARRISON, N. J.

THE LEHIGH VALLEY

CREOSOTING CO.

WORKS, PERTH AMBOY, N. J.

Office, Foot of Washington Street, JERSEY CITY, N. J.

Creosoted Lumber, Underground Conduits. Telegraph Poles, Piling and Ties Furnished.

HOMER SHOEMAKER,

Attorney and Counsellor-at-Law,

HARRISBURG, PA

Special attention given to matters affected by the corporation laws of Pennsylvania.

IRON MOUNTAIN ROUTE **BEST LINE** TO **TEXAS**

ONLY LINE with Daily Through Sleeping Car Service between ST. LOUIS and FT. WORTH, TAYLOR, AUSTIN, SAN ANTONIO, LAREDO and GALVESTON.

ONE WHOLE DAY SAVED.

H. C. TOWNSEND, G. P. & T. Agt, ST. LOUIS, MO.

Established 1847. Purely Mutual.

INSURE IN

The PENN LIFE Company,

— OF —

PHILADELPHIA, PA.

WHY?

IT IS THE BEST!

Assets, - - $18,551,388.30

Surplus, - - 2,465,689.13

Apply for Rates to

EZRA DE FOREST, Gen'l Agent,

13 Park Row, New York.

FIDELITY CARBON MANUFACTURING CO.,

ST. LOUIS, MO.

ARC LIGHT CARBONS,

CARBON BRUSHES, PLATES & SPECIALTIES,

BATTERY CARBONS.

Sole Manufacturers Special High Grade Carbons for Ward Lamps.

THE BILLINGS WIRE CUTTER

Drop forged from the best Tool Steel

Six Cutting Edges

Adjustable Gauge

Workmanship the Best

Length 10 inches

The Billings & Spencer Co., Hartford, Conn.

Washburn & Moen Manufacturing Co.

MAKERS OF IRON, STEEL AND COPPER.

MANUFACTURERS OF

IRON, STEEL AND COPPER WIRE

FOR ALL PURPOSES.

OLDEST and LARGEST

MANUFACTURERS OF

ELECTRICAL WIRES

IN THE WORLD.

FACTORIES & ROLLING MILLS:
GROVE ST., WORCESTER, MASS.
QUINSIGAMOND, MASS. (NEAR WORCESTER.)
WAUKEGAN, ILL. (NEAR CHICAGO.)

OFFICES AND WAREHOUSES:
NEW YORK, PHILADELPHIA,
PITTSBURGH, SAN FRANCISCO,
CHICAGO, WORCESTER, MASS.

THE EXCLUSIVE MANUFACTURERS OF

The ONLY absolutely FIRE and WATER-PROOF Insulated WIRE Made.

INSULATED Iron, Steel and Copper Wire for electrical purposes A SPECIALTY.

PATENT GALVANIZED TELEGRAPH AND TELEPHONE WIRE IN LONG LENGTHS.

GALVANIZED BY OUR PATENT CONTINUOUS PROCESS.

THE STANDARD WITH TELEGRAPH AND TELEPHONE COMPANIES.

Since the introduction of the electric telegraph and telephone service, our Patent Wire manufactured expressly for electrical purposes has filled every requisition as regards *strength, uniformity* and *conductivity*.

Price-lists, descriptive pamphlets, and "Pocket Hand-book of Iron and Copper Wire in Electric Transmission" free on application.